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Contents

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Volume 1 Part 1 15 September 1976

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Papers will be accepted in the following categories:

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FOREWORD

It is a truism that in our society most of the existing knowledge which we have, and the new knowledge which we are constantly acquiring, is brought to us through the published work of those people who have done the original thinking by study or research.

It is of fundamental importance, therefore, that those who perform the research for new knowledge in their specialist field should make their findings known by having them recorded in a suitable publication having a wide distribution to libraries and interested persons. This pre-supposes that adequate and suitable publishing media, such as technical journals and the like, exist and have the necessary space available.

It is known that in Australia the facilities for publishing papers in the field of horticultural botany are most inadequate, and that workers in this field are met by long and frustrating delays in having papers accepted for publication. Similar problems exist in South Australia, particularly in the field of taxonomic botany.

It is because of this that the Board of Governors of the Adelaide Botanic Garden decided to promote the publication of this new journal in the hope that it will be a medium through which botanists, wherever they are working, may have worthwhile contributions published without undue delay.

"The Journal" will accept original articles on a wide range of aspects of descriptive botany, particularly those on the systematics of the Australian flora and on horticultural plants.

It is hoped to encourage work on the South Australian flora by providing a publication which will accept both detailed monographic work and briefer notes. It will provide a repository for historical and biographical articles and field data relating to Australian botany and horticulture.

It may also be the means of collecting work by botanical artists showing a range of styles and techniques depicting plants which hitherto have not been illustrated, or have been poorly documented. Periodically books which relate to the plant sciences will be reviewed.

Finally it is hoped to foster closer liaison between the botanist and horticulturist, especially in the southern hermisphere, and particularly amongst plant groups in which they share a common interest.

D. SCOTT YOUNG
Chairman, Board of Governors
Botanic Garden Adelaide

30 August, 1976

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A TAXONOMIC REVISION OF THE GENUS *SPARTOTHAMNELLA* (CHLOANTHACEAE)

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Abstract

A taxonomic revision of *Spartothamnella* Briq. is provided. The features shared by the genus with Myoporaceae are discussed. Three species are recognized of which each one is typified for the first time. The affinities and distribution are considered for the genus and each species. A new key to the species is provided and a detailed revised description of each taxon is supplemented by a habit sketch of a flowering branch and analytical drawings of the flowers.

Taxonomic History of the Genus

The genus *Spartothamnus* was proposed by Cunningham (1830), with a single species, *S. junceus,* which he had collected himself in "the interior of the Colony" (i.e. what is now New South Wales and Queensland). It was referred to the family Myoporineae but, lacking a description, remained a nomen nudum (see comments on p. 5). The name was validated by Walpers (1847), when he published a detailed description, again placing it in the Myoporineae. However, the homonym *Spartotamnus* had previously been validly published by Presl (1844) for another genus, in the Leguminosae, and Walpers' name was, therefore, illegitimate. Later, in the same year, De Candolle (1847) republished Walpers' description, also placing the genus in the Myoporineae. The name had been taken up by several authors, none of whom gave any of its characters, all placing it in the same family, i.e. Endlicher (1836), Spach (1840), Meisner (1840), Walpers (1845) and Lindley (1846, 1847).

In 1868, F. Mueller transferred it to the Verbenaceae with the remark that the genus seemed to be transitional between Myoporaceae and Verbenaceae. The majority of botanists have retained the genus in this family, except Carruthers (1870) who kept it in the Myoporaceae. In 1870, Bentham referred this genus to the predominantly Australian subtribe Chloanthinae ("Chloantheae") of the tribe Viticeae in the Verbenaceae. Subsequently, Bentham & Hooker (1876) upgraded the subtribe Chloanthinae ("Chloantheae") to the tribe Chloantheae, without altering the circumscription of its genera. This tribe was accepted for the genus by Durand (1888), Bailey (1883, 1890, 1901, 1913), Post & Kuntze (1904) and Lemée (1943). The genus consisted of a single species until F. Mueller added *S. teucriiflora* (1882) and *S. puberula* (1882, 1889).

In 1895, Briquet replaced the illegitimate name *Spartothamnus* A. Cunn. ex Walp. by *Spartothamnella.* Briquet's name was adopted by Maiden & Betche (1916), Black (1957), Moldenke (1959, 1971), Beadle et al (1963, 1972), Burbidge (1963), Blackall & Grieve (1965), Airy Shaw (1966, 1973), Beard (1970), Chippendale (1971) and Clifford & Ludlow (1972). Briquet also upgraded the tribe Chloantheae to a subfamily Chloanthoideae. The latter consisted of three tribes: Achariteae, Chloantheae and Physopsideae, with *Spartothamnella* in the tribe Achariteae. This classification was adopted by Dalla Torre & Harms (1904) and Junell (1934).

In 1904, Diels & Pritzel revised the Western Australian Verbenaceae comprising only Bentham & Hooker's tribe Chloantheae. They subdivided the tribe into two subtribes viz. Lachnostachydinae and Chloanthinae, placing *Spartothamnella* ("Spartothamnus") in the latter. Gardner (1931) retained *Spartothamnella* ("Spartothamnus") in Briquet's subfamily Chloanthoideae, but within the subfamily he referred it to Diels & Pritzel's subtribe Chloanthinae without naming any tribe.

Hutchinson (1959) raised the status of Bentham & Hooker's tribe Chloantheae to the family Chloanthaceae to which this genus was referred, which differed from Verbenaceae (s.str.) chiefly in the albuminous seeds. The new family was accepted by Takhtajan (1959, 1969), Eichler (1965), Symon (1969), Gardner (1972) and Munir (1975, 1976). Also in 1959, Moldenke published a résumé of the world Verbenaceae and referred *Spartothamnella* and its allied genera to the family Stilbaceae. Within this family, the genus was retained in Briquet's subfamily Chloanthoideae, tribe Achariteae of the Verbenaceae.

In 1965, Airy Shaw referred all genera of Australian Verbenaceae (s.lat.) with albuminous seeds to the family "Dicrastylidaceae Drumm. ex Harv.", which although mentioned by Harvey (1855) was not validated and was, therefore, a nomen nudum. Dicrastylidaceae has been adopted for "Australian Verbenaceae" with albuminous seeds by Airy Shaw (1966, 1973), Beard (1970), Moldenke (1971), Maconochie & Byrnes (1971), George (1972) and some others, but is regarded here as a synonym of the Chloanthaceae. Nevertheless, in the majority of recent publications, *Spartothamnella* and its related genera have been recorded in the Verbenaceae.

In the present revision, *Sparthothamnella* is retained in the family Chloanthaceae although it does have some characters suggesting an affinity with the Myoporaceae.

SPARTOTHAMNELLA Briquet

Spartothamnella Briq. in Engl. & Prantl (eds), Natürl. Pflanzenfam. 4, 3a (1895) 161; Black, Fl. S. Aust. 2 ed. (1957) 725; Mold., Résumé Verben. etc. (1959) 345, 404; Burb., Dict. Aust. Pl. Gen. (1963) 275; Mold., Fifth Summary Verben. etc. 2 (1971) 622, 623, 750; Beadle et al., Fl. Syd. Region (1972) 506; Airy Shaw, Willis' Dict. Fl. Pl. & Ferns, 8 ed. (1973) 1082.

Type species: S. juncea (A. Cunn. ex Walp.) Briq. in Engl. & Prantl (eds) Natürl. Pflanzenfam. 4, 3a (1895) 161.

Spartothamnus A Cunn. (in Loud. Hort. Brit. (1830) 600, nom. nud.) ex Walp., Rep. Bot. Syst. 6 (1847) 694, non Presl (1844); DC., Prod. 11 (1847) 705; Benth., Fl. Aust. 5 (1870) 55; Pfeiff., Nomenc. Bot. 2 (1874) 1208; Benth. & Hook. f., Gen. Pl. 2 (1876) 1141; Diels & Pritzel, Bot. Jahrb. 35 (1904) 513; Hutch., Fam. Fl. Pl. 1, 2 ed. (1959) 398.

Type species: S. junceus A. Cunn. ex Walp., Rep. Bot. Syst. 6 (1847) 694.

Number of Species 3.

Derivation of the name

Spartothamnus was probably derived from the Greek words *spartos* and *thamnos*, meaning cord and bush. It is possible that the name alluded to the plant's similarity to the Spanish broom, *spartos*, so named because it was used in making cord. The Latin suffix *ella* denotes the diminutive.

Description

Shrubs or undershrubs. *Stem* branched, 4-angled, solid and woody. *Leaves* cauline and ramal, exstipulate, simple not decurrent. *Flowers* 1-3 in a short axillary cyme, bracteate, with 2-lateral bracteoles, zygomorphic, bisexual, hypogynous. *Calyx* of 5 fused sepals, persistent, deeply 5-lobed, tubular below, spreading under the fruit. *Corolla* of 5 fused petals, caducous, 2-lipped or unequally 5-lobed in the upper half, tubular below; lobes spreading, the anterior (i.e. the middle lower) lobe rather larger than the others; tube short and broad, villous inside. *Stamens* 4, epipetalous, exserted; filaments filiform, glabrous in the upper half, villous towards the base, the anterior two (i.e. beside the middle lower corolla lobe) longer than the posterior two; anthers dorsifixed, 2-lobed, 1-chambered by the confluence of lobes, ± reniform, glandular on the back; lobes free and divergent, muticous at the lower end, longitudinally dehiscent. *Ovary* bicarpellary, syncarpous, 4-locular, with one axile semi-anatropous ovule in each cell; style filiform, exserted, 2-lobed in the upper half. *Fruit* a globose succulent drupe, the endocarp

separating into 4 one-seeded fruitlets. Seeds exalbuminous; embryo straight, with thick cotyledons and an inferior radicle.

Distribution (Map 1)

The genus *Spartothamnella* is endemic in Australia. Two out of three species, *S. juncea* and *S. puberula*, are restricted chiefly to Queensland and New South Wales with only three localities of *S. puberula* in the Northern Territory. The third species, *S. teucriiflora*, occurs in Western Australia, Northern Territory and South Australia. No records are known from Victoria or Tasmania. (See Addendum at end of paper.)

Map 1: Distribution of the genus *Spartothamnella* Briq.

Comments

Although Loudon's (1830) publication of Cunningham's proposed name, *Spartothamnus*, has been treated by all subsequent authors as lacking a description and, therefore, invalid, it does contain some descriptive material and the possibility of its fulfilling the needs of a description or diagnosis (ICBN Art. 32) must be considered.

The descriptive material falls into two sections:

(a) The translation of the generic name (broom-like habit);

(b) The translation of a series of symbols and abbreviations, followed by the name Myoporineae. Some of this is of horticultural significance only; the relevant part providing that it is a shrub three feet high, with white flowers, flowering in August and September and originating in Nova Hollandia.

Article 32 requires either a description or a diagnosis. It does not define a description, but most botanists would probably agree that if a description is very short it should be

treated as a diagnosis and for diagnoses the code does provide a definition. Stafleu (pers. comm.) suggests that Loudon's text could be treated as a diagnosis. For a diagnosis to comply with the requirements of Article 32 it must be "a statement of that which in the opinion of its author distinguishes the taxon from others". However, Recommendation 32B might be seen to contradict this interpretation as it recommends that descriptions (and diagnoses) "should mention the points in which the taxon differs from its allies", thus implying that descriptions are not invalid just because they do not mention these diagnostic characters. Despite this uncertainty, the most useful criterion is probably whether or not Loudon's information complies with the definition of a diagnosis in Article 32.

The translation of the generic name could be considered part of the diagnosis. However, the name was supplied by Cunningham, whose authorship Loudon acknowledged, and there is no evidence that Loudon regarded this information as diagnostic. At that time several members of the Myoporaceae with a broom-like habit were known.

The remaining text contains certain points listed in a similar format and under the same headings for all the species dealt with in the catalogue. None of the information was selected in order to distinguish this new plant from any others and it is unlikely that Loudon considered that it was diagnostic.

It is, therefore, the opinion of the present author that Loudon's work must be examined against the definition of a diagnosis in Article 32 of the Code and that it does not meet these requirements. As this decision agrees with that of previous botanists, it can also be supported on the grounds that it maintains current usage and, therefore, nomenclatural stability.

Briquet (1895) replaced the generic name *Spartothamnus* A. Cunn. ex Walp. with *Spartothamnella* because the name *Spartothamnus* had been previously validly applied to a genus in the Leguminosae by Presl (1844). Dalla Torre & Harms (1904) followed Briquet's arrangement of the major taxa of Verbenaceae but used the name *Spartothamnus.* The generic name *Spartothamnus* was also retained by Post & Kuntze (1904), Gardner (1931) and Lemee (1943), with *Spartothamnella* in synonymy.

The presence of minute tips or appendages at the base of anther-lobes in two genera of the Chloanthaceae *(Spartothamnella* and *Pityrodia)* is mentioned by Bentham (1870), Bentham & Hooker (1876), Bailey (1901), Diels & Pritzel (1904), Hutchinson (1959), Moldenke (1959, 1971) and others, but during the present study these were not found in any species of this genus.

Affinities

Spartothamnella (= Spartothamnus) was proposed by Cunningham (1830) in the Myoporaceae and retained there by Endlicher (1836), Spach (1840), Meisner (1840), Walpers (1845, 1847), Lindley (1846, 1847, 1853), de Candolle (1847) and Carruthers (1870). With the exception of the last author, they considered its relationship to be with the genera *Eremophila* and *Pholidia* in the Myoporaceae.

In 1868, F. Mueller transferred *Spartothamnella (= Spartothamnus)* to the Verbenaceae, but regarded the "genus transitional between Myoporaceae and Verbenaceae". He noted that the habit of this genus, division of the stigma and the absence of albumen in the seeds are entirely different from the Myoporaceous plants. Following F. Mueller (1868), the genus was retained in the Verbenaceae by Bentham (1870), Bentham & Hooker (1876), Briquet (1895) and many others.

Recently, however, it was placed in the Chloanthaceae by Hutchinson (1959), in the Stilbaceae by Moldenke (1959) and in the Dicrastylidaceae by Airy Shaw (1965, 1966, 1973) and Moldenke (1971). These families are segregated from, but closely related to Verbenaceae. In the Verbenaceae (s. lat.) and Chloanthaceae, the genus has been

considered "very nearly allied to *Pityrodia*" (Bentham, 1870; Bailey 1901; Hutchinson 1959) chiefly due to their non-decurrent leaves and the mistaken belief that there is a minute tip ("appendage") at the base of the anther-lobes. In the Stilbaceae and Dicrastylidaceae, however, *Spartothamnella* is placed near *Nesogenes* and *Cyclocheilon* because of the cymose inflorescence, fleshy exocarp of their fruit and the supposedly albuminous seeds (Moldenke, 1959, 1971).

In the majority of publications, *Spartothamnella* is retained in the tribe Chloantheae of Verbenaceae (s. lat.) or its segregate families apparently on the assumption that it has albuminous seeds and ("minutely") apiculate anther-lobes. Both of these characters were reported for the genus by Bentham (1870) and adopted by others without verifying them. In the present study, however, neither of these characters was found in the genus, although there are other important characters shared by *Spartothamnella* with the Verbenaceae (s. lat.) or its segregate families. On the other hand, other significant features suggest a possible affinity with the Myoporaceae. The relationship of *Spartothamnella* with both the Myoporaceae and the Verbenaceae or its segregate families is, therefore, discussed (table 1).

Spartothamnella has the following characters in common with the Verbenaceae (s. str.): leaves decussate, exstipulate; flowers tubular, bracteate; calyx persistent; stamens epipetalous, anthers dorsifixed, 2-lobed, longitudinally dehiscent, non-apiculate; ovary not lobed, 4-ovuled; ovule placentation axile; seed without albumen. Nevertheless, the Verbenaceae (s. str.) differs from *Sparthothamnella* in the following characters: inflorescence usually racemose, spicate or paniculate; flowers without 2 lateral bracteoles; anther-lobes not confluent at the top end. In contrast to *Spartothamnella* which is restricted to Australia, the Verbenaceae (s. str.) are widely distributed in both hemispheres.

In many characters, the Chloanthaceae (= Dicrastylidaceae) are also close to *Spartothamnella*. They agree with each other in having the following characters in common: leaves simple, exstipulate, decussate; inflorescence cymose; flowers tubular, bracteate, with 2 lateral bracteoles; calyx persistent; stamens 4, epipetalous; anthers 2-celled, longitudinally dehiscent; ovary not lobed; ovules pendulous and anatropous. Both *Spartothamnella* and the Chloanthaceae are endemic in Australia. The genus *Spartothamnella*, however, is easily distinguished by its very small flowers (3-8(-12)mm long), confluent anther-lobes at the apex to become unilocular, succulent drupaceous fruit and ex-albuminous seeds.

There are a few characters common to *Spartothamnella* and the Myoporaceae. Both of them have the following characters: leaves simple; flowers axillary, solitary or in cymes; calyx persistent, 5-lobed; corolla tubular, 2-lipped; stamens 4, epipetalous; anthers 2-lobed, the lobes confluent at the apex forming a single reniform cell; pollen grains isopolar, radiosymmetrical and 3-colpate; ovary non-lobed; ovules pendulous, anatropous; placentation axile; fruit succulent drupe. *Spartothamnella* and the Myoporaceae are largely endemic in Australia. The family Myoporaceae, however, is readily distinguished by its mostly alternate or scattered leaves; flowers without bracteoles; calyx often less than half the length of corolla-tube; ovary 2-celled; stigma almost entire, (i.e. not deeply 2-lobed); seeds albuminous. There are oil glands in the Myoporaceae which are not found in *Spartothamnella*.

The above mentioned similarities in the characters of *Spartothamnella* and different families show that the genus is related to them to a certain degree. In the majority of its characters, however, it seems more closely related to the Chloanthaceae, but the many important characters shared between this genus and the Myoporaceae cannot be overlooked. Therefore, although it is retained here in the Chloanthaceae, the present author agrees with F. Mueller (1868) in regarding the genus transitional between Chloanthaceae and Myoporaceae. Note: In 1868, the Chloanthaceae had not been segregated from the Verbenaceae (sensu lato).

		Verbenaceae (s. str.)	Chloanthaceae (=Dicrastylidaceae)	Spartothamnella	Myoporaceae
Leaves	mostly decussate	+	+	+	–
Flowers	with 2 bracteloes	–	+	+	–
Corolla	2–lipped	+	±	+	+
Androecium	stamens mostly 4	±	±	+	+
	anther-lobes confluent at the apex forming a 1–chambered reniform cell	–	–	+	+
	anther-lobes apiculate at the lower end	–	±	–	–
Gynoecium	ovary not lobed	±	+	+	+
	ovary mostly 4–celled	±	+	+	–
	stigma 2–lobed	±	+	+	–
Fruit	succulent drupe	±	–	+	±
Seed	albuminous	–	+	–	+
Oil glands	present	±	–	–	+
Endemic	in Australia	–	+	+	90%

Table 1. Table to show the diagnostic characters of the genus *Spartothamnella* and the families Verbenaceae (s. str.), Chloanthaceae and Myoporaceae.

(+ = present; – = absent; ± = sometimes present.)

Key to the Species

1. (a) Plant pubescent with branched hairs; flowers sessile; calyx longer than corolla .... 1. *S. puberula*

   (b) Plant glabrous of grey-puberulous in young plant with simple hairs; flowers pedicellate; calyx shorter than corolla 2

2. (a) Plant glabrous; stem acutely 4-angled, longitudinally striate; pedicel and calyx glabrous .... 2. *S. juncea*

   (b) Plant grey-puberulous when young, later glabrescent; stem obtusely 4-angled, non-striate; pedicel and calyx grey-puberulous .... 3. *S. teucriiflora*

1. Spartothamnella puberula (F. Muell.) Maid. & Betche, Cens. N.S.W. Pl. (1916) 177; Mold., Resume Verben. etc. (1959) 210, 345; Chipp., Proc. Linn. Soc. N.S.W. 96 (1971) 256; Mold., Fifth Summary Verben. etc. 1 & 2 (1971) 348, 622, 623.

Type: F. Mueller, s.n.: From near the Suttor River, Queensland — 1856 (MEL 68872, lectotype; K).

Spartothamnus puberulus F. Muell., Sec. Syst. Cens. Aust. Pl. 1 (1889) 171 — Basionym (In listing this species in the Second Census, Meuller refers back to his note in Wing's South. Sc. Rec. 2 (1882) 55, where he showed how it differs from *Spartothamnus junceus,* and merely suggests that it should be given specific rank); Tate, Trans. & Proc. R. Soc. S. Aust. 12 (1889) 113; Tate, Fl. Extratrop. S. Aust. (1890) 254, 302; Bail., Cat. Indig. & Natur. Pl. Qld. (1890) 35; Tate in Spencer (ed.), Horn Sc. Exped. 3 Bot. (1896) 174; Diels & Pritzel, Bot. Jahrb. 35 (1904) 513; Dixon, Pl. N.S.W. (1906) 236.

Type: As for *Spartothamnella puberula* (F. Muell.) Maid. & Betche.

S. junceus A. Cunn. ex Walp.: Benth., Fl. Aust. 5 (1870) 55 p.p. [quoad spec. A. Cunningham 246, Mt Aiton, Peel's Range, N.S.W. — K]; Bail, Qld. Fl. 4 (1901) 1169 p.p. quoad descr. "pubescent with branching hair".

S. junceus A. Cunn. ex Walp. var. *puberulus* Bail., Qld. Fl. 4 (1901) 1170.

Type: Barton 230, between the Warrego and Maranoa Rivers, Queensland (MEL); syntype of *S. puberula* (F. Muell.) Maid. & Betche.

S. puberulus Bail., Cat. Qld. Pl. (1913) 381 nom. nud.

Typification

S. puberulus F. Muell is based on three syntypes from Queensland, one collected by F. Mueller (the author) from near the Suttor River, the other by Bowman from near the Cape River and the third one by Barton from between the Warrega and the Maránoa Rivers. Of the above mentioned syntypes, the one collected by F. Mueller from near the Suttor River seems a better representative of this species and is, therefore, designated here as the lectotype.

Description (Fig. 1)

An erect branched shrub 0.5 - 1 (-1.5) m high, puberulous-pubescent with branched (± stellate) hairs. *Stem* of several rigid divaricate branches arising from a woody rootstock, dull green, acutely 4-angled, longitudinally striate. *Leaves* sessile, linear-lanceolate, narrowly elliptic or sometimes ovate-lanceolate, entire, recurved along the margin, (0.5-) 1 - 2.5 (-3) cm long, 2 - 4 (-6) mm broad, puberulous-pubescent. *Flowers* solitary, axillary, sessile, borne towards the end of branches; bract leafy, sessile, linear-lanceolate with somewhat recurved margins, 0.5 - 1 (-1.5) cm long, 1 - 2 (-4) mm broad, pubescent; bracteoles sessile, linear or linear-lanceolate, persistent, (1-) 1.5 - 2.5 (-3) mm long, (0.3-) 0.5 - 1 mm broad, pubescent. *Calyx* longer than corolla, (2-) 2.5 - 3.5 (-4) mm long, pubescent all over, densely glandular outside, sparsely so on the inner face of the lobes; lobes narrow lanceolate, spreading, longer than the tube, strongly ribbed at the back, 1.5 - 2.5 (-3) mm long, (0.2-) 0.3 - 0.5 (-1) mm broad at the base; tube broad, glabrous inside, 0.5 - 1 mm long. *Corolla* greenish-white, 2.5 - 3 mm long, glandular and puberulous outside, glabrous within excepting the villous throat; anterior-lobe ± elliptic-oblong, 1.5 - 2 mm long, ± 1 mm broad; the other 4-lobes almost equal, broadly elliptic-ovate, 1 - 1.5 mm long, 0.5 - 1 mm broad at the base; tube broad, cylindrical, ± 1 mm long. *Stamens* shortly exserted; filaments filiform, the anterior two 1.5 - 2 mm long, the posterior two 1 - 1.5 mm long; anthers ± reniform in outline, glandular on the back, 0.3 - 0.5 mm long, 0.2 - 0.3 mm broad, lobes ± rounded. *Ovary* ± globose in outline, faintly 4-lobed when young, sometimes cuneate towards the base, (0.5-) 1 - 1.5 mm long, 0.5 - 1 mm in diameter at the upper end, puberulous and glandular at the top, glabrous below; style shortly exserted, filiform, (1-) 1.5 - 3mm long, glabrous, sometimes puberulous towards the base. *Fruit* globular, orange-red, often scarcely exceeding the persistent open calyx, 2.5 - 4 mm in diameter, glabrous, smooth.

Specimens examined

QUEENSLAND: *Barton 230,* between the Warrego and Maranoa Rivers, 1867 (MEL *syntype*). *Bick s.n.,* Charleville, Dec. 1916 (BRI 190721 and 190722, NSW 135923). *Bowman s.n.,* Cape River, undated (MEL 68873

syntype). *Clemens s.n.*, Jericho, 1.v. 1946 (BRI 070166, GH). *Dockrill 411*, Barrabas, Atherton Tableland, 17.v. 1972 (BRI). *Domin 3025, 3132, 3181 and 8101*, near Jericho, Nov. 1910 (PR). *Everist 3091*, Boatman Stn., 17. vii. 1947 (BRI, NY). *Macuean 1*, Warrego River, 1888 (MEL). *Mikee 10345*, Cunnamulla, 12 iv. 1963 (NSW). *F. Mueller s.n.*, Alice River, undated (P); *s.n.*, Burnett River, undated (GH p.p., K); *s.n.*, Suttor River, "Suttor Range", 1956 (MEL 68872 lectotype; K). *Shirley s.n.*, Charleville, undated (BRI 190723). *White 9461*, Roma, 24.x. 1941 (BRI); *12020*, Morven, 6.iv. 1941 (A, BRI); *12400*, Enniskillen Mt., 14.xi. 1943 (A, BRI, US).

NEW SOUTH WALES: *Althofer s.n.*, along Girilambone to Booramugga road, 1970 (NSW 135924). *Betche s.n.*, "Gilargambone", Oct. 1886 (G). *Boorman s.n.*, Byrock, Nov. 1903 (G, NY). *Cunningham 246*, Mt. Aiton, Peel's Range, l.vi. 1817 (K, syntype of S. *junceus* A. Cunn. ex Walp.). *Cunningham & Milthorpe 2520*, 32 km NW of Condobolin, 16.vii. 1974 (NSW). *Maclean s.n.*, Trangie, Feb. 1951 (NSW 135925). *F. Mueller s.n.*, Warrego River, undated (GH). *Rat s.n.*, Byrock, undated (P). *Anon. s.n.*, Girilambone, Nov. 1890 (US, W).

NORTHERN TERRITORY: *Latz 655*, Old Huckitta Homestead, 20.vii. 1970 (NT); *1930*, Georgina Range 23° 27' 134° 23', 7.i. 1972 (AD, CANB, NT). *Tate s.n.*, Mt. Gillen *c.* 5 km W. of Alice Springs, 1894 (AD, K).

Distribution (Map 2)

S. puberula is known chiefly from Queensland and New South Wales with a few localities in the Northern Territory. Distribution in Queensland is mainly between lat. 20° and 33° S. and between long. 145° and 148° E. The only other unspecified locality (in Qld.) is near the Burnett River along the Burnett Highway, Queensland. In New South Wales, one specimen was collected from NW of Condobolin and all the rest from between Dubbo and Barringun along the Mitchell Highway. In the Northern Territory, it is known from west of Alice Springs and near the Georgina Range and Jervois Range.

Map 2: Distribution of *Spartothamnella puberula* (circles) and of *S. juncea*.

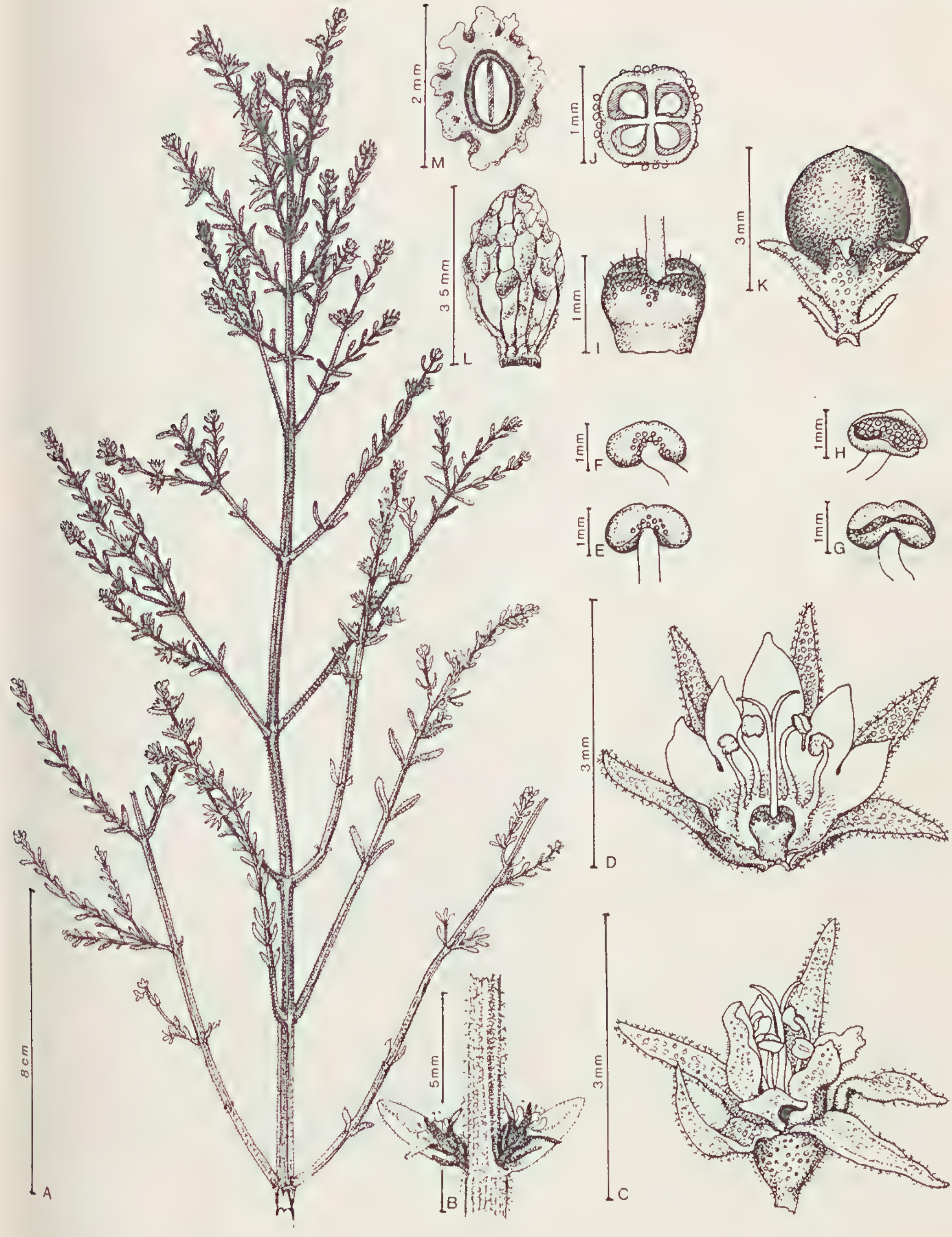


Fig. 1. *Spartothamnella puberula* (F. Muell.) Maid & Betche (*M. S. Clemens* s.n.: BRI 070166). A, habit drawing; B, portion of stem showing longitudinal striation, branched hairs and solitary axillary flowers with bract and bracteoles; C, flower; D, flower with calyx and corolla vertically cut open showing androecium and gynaeceum; E, back view of undehisced anther; F, back view of dehisced anther; G, front view of semi-dehisced anther; H, front view of dehisced anther showing the single chamber formed by the confluent anther-lobes at the apex; I, ovary; J, T.S. ovary; K, fruit with persistent calyx; L, corrugate fruitlet; M, T.S. fruitlet.

Moldenke (1959, 1971) recorded this species from South Australia, but its occurrence in that state has not been confirmed. (See Addendum at end of paper.)

Comments

Bailey (1901) cited *Spartothamnus puberulus* F. Muell. (1882) as a synonym for his own *S. junceus* var. *puberulus,* although in 1882 Mueller had merely proposed the epithet in anticipation of the acceptance of this species. In terms of Article 34 of the International Code of Botanical Nomenclature (1972) the name had therefore not been validly published in 1882. In 1913, Bailey again cited *S. puberulus* as a synonym for the same variety but gave himself as author, apparently realizing his previous error but not realizing that Mueller had, in 1889, formally validated the name. Bailey did not at any stage provide his own description for his variety, depending instead on diagnostic features supplied by Mueller in 1882: The variety and species, although bearing the same epithet and depending on the same diagnosis are not based on a common basionym and do not necessarily have the same type. Bailey cited only one specimen, which must, therefore, be the type for the variety. Mueller cited several specimens (including the type of var. *puberulus*) but the lectotype of *S. puberulus* chosen by the present author is not the type of *S. junceus* var. *puberulus.* These names are therefore taxonomic but not nomenclatural synonyms.

The corolla and epipetalous stamens often fall off long before the fruiting stage and are often missing in a well developed flower.

Tate's collection (AD 95836012) from Mt Gillen, N.T., has the largest leaves measuring up to 3 by 0.6 cm and more dense tomentum than any other known collection of this species.

Betche's collection from New South Wales is noted to have come from "Gilargambone", which is probably an error for the locality Girilambone where this species is known to grow commonly.

Affinity

This species seems nearer to *S. teucriiflora* in having a hairy covering all over the stem, leaves and on the outside of calyx and corolla. Nevertheless, it may be easily distinguished by its pubescence being stellately hairy, leaves more copiously developed, flowers sessile and calyx longer than corolla.

2. Spartothamnella juncea (A. Cunn. ex Walp.) Briq. in Engl. & Prantl. Pflanzenfam. 4. 3a (1895) 161; Maid. & Betche, Cens. N.S.W. Pl. (1916) 177; Mold., Resume Verben. etc. (1959) 210, 211, 345; Mold., Fifth Summary Verben. etc. 1 & 2 (1971) 348, 350, 623, Beadle et al., Fl. Syd. Region (1972) 506.

Type: A. Cunningham 78, Brisbane River, Queensland, x.1824 (K, lectotype; K, W).

Spartothamnus junceus A. Cunn. [in Loud. Hort. Brit. Suppl. (1830) 600, nom. nud.] ex Walp., Rep. Bot. Syst. 6 (1847) 694 — *Basionym;* DC., Prod. 11 (1847) 705; F. Muell. Fragm. 6 (1868) 153; Benth., Fl. Aust. 5 (1870) 55 p.p. (exclud. F. Muell. s.n., Burnett River, Queensland and Cunningham 246, Mt Aiton, Peel's Range, N.S.W.); Bail., Qld. Fl. 4 (1901) 1169 p.p. (exclud. F. Muell. s.n., Suttor Range and Burnett River, Queensland and descrip. "pubescent with branching hairs"); Diels & Pritzel, Bot. Jahrb. 35 (1904) 513; Dixon, Pl. N.S.W. (1906) 236; Bail., Qld. Agric. Journ. 28 (1912) 199; Bail., Cat. Qld. Pl. (1913) 381; White, Qld. Agric. Journ. 13 (1920) 29; Blake et al., Proc. Roy. Soc. Qld. 52 (1941) 73.

Type: As for *Spartothamnella juncea* (A. Cunn. ex Walp.) Briq.

Typification

Allan Cunningham (1830) proposed the name *Spartothamnus junceus* for the only species of a new genus which he had collected "from the interior of the Colony" (i.e. New South Wales & Queensland). This name was not validated until 1847 when Walpers published a detailed description. Walpers had seen living material in the Berlin Botanic Gardens and considered Cunningham to be the author of the binomial, but did not specifically cite any Cunningham herbarium collection. De Candolle, later in the same

year, republished Walper's description and added that he had seen at least one of Cunningham's collections and, in addition, that there were specimens in both the Berlin herbarium and his own. He did not make clear whether these specimens were Cunningham's collections or had been made from the plant(s) growing in the Berlin Botanic Gardens. It is probable that Walpers had had access to the same specimens as De Candolle had and that he had, therefore, also seen original Cunningham's specimens. It is not known whether these Cunningham specimens belonged to the Berlin Herbarium or had been borrowed from elsewhere. There are now no specimens of this species in the Berlin Herbarium (where it is likely they were destroyed during the last war) or in the De Candolle Herbarium (G). Cunningham's specimens occur in several herbaria (Lanjouw & Stafleu, 1954), but his collections of this species have only been traced at Kew and Vienna (W). It is considered extremely probable that Walpers did see one or more of these specimens. (The Kew specimens were at that time in the possession of Cunningham's friend, Robert Heward). It is also very likely that any specimens which may have been in Berlin were duplicates of specimens now in Kew or Vienna.

It is, therefore, proposed to select a lectotype from this material. None bears annotations by Walpers, which could have been used as a guide in choosing the lectotype.

There are six herbarium sheets of Cunningham's collections of *Spartothamnella* in Herb. K and four in Herb. W. One of these in Herb. K, collected from Mt Aiton on 1st June, 1817, numbered 246, is found to be of a different species, *S. puberula* (F. Muell.) Maid. & Betche. Since this specimen does not agree with the type description because it is pubescent with branching hairs, it therefore seems very unlikely that Walpers (1847) used this in preparing the original description and it is, therefore, excluded. Of the remaining five specimens at Kew, the one labelled "Coll. no. 78", gathered from Brisbane River, in October, 1824, seems the best representative of this species and is therefore selected here as the lectotype. A duplicate is in Herb. K and another in Herb. W.

Description (Fig. 2)

A scrambling shrub 1 - 2 (-3) metres high. *Stem* dark-green, acutely 4-angled, longitudinally striate, glabrous, somewhat glutinous. *Leaves* caducous, sessile or very shortly petiolate, narrowly elliptic or elliptic-oblong, obtuse, entire, (3-) 4 - 10 (-18) mm long, (1-) 2 - 3 (-5) mm broad, glabrous, somewhat glandular when young; petiole 1-2 mm long, glabrous, glandular. *Flowers* axillary, solitary, rarely more, pedicellate; pedicel (1-) 2 - 3 (-4) mm long, glabrous; bracts almost sessile, ovate-oblong, 0.5 - 1 (-1.5) mm long, ± 0.5 mm broad, glandular and puberulous on the outer (i.e. lower) surface, almost glabrous above; bracteoles sessile, linear, ± 1 mm long, puberulous-ciliate along the margin. *Calyx* deeply 5-lobed, sometimes 6-lobed, 1.5 - 2.5 mm long, glabrous, glandular outside only; lobes narrow lanceolate, spreading, strongly ribbed, 1 - 2 mm long, 0.5 - 1 mm broad at the base; tube 0.5 - 1 mm long. *Corolla* "white", 3 - 4 mm long, scarcely puberulous outside the tube, ± villous in the throat; anterior-lobe ± oblong, 1.5 - 2.5 mm long, 1 - 1.5 mm broad; the other 4-lobes almost equal, ± ovate, 1 - 1.5 mm long, ± 1 mm broad at the base; tube ± cylindrical, (0.5-) 1 - 1.5 (-2) mm long. *Stamens* shortly exserted; filaments filiform, the anterior two (1.5-) 2 - 2.5 (-3) mm long, the posterior (lateral) two 1 - 1.5 (-2) mm long; anthers ± reniform in outline, glandular at the back, 0.5 - 1 mm long, 0.3 - 0.5 mm broad; lobes ± rotundate. *Ovary* ± globose, faintly 4-lobed at the top end, 1 - 1.5 mm in diameter, glandular and puberulous in the upper half, glabrous below; style exserted, filiform, 3 - 4 mm long, glabrous. *Fruit* globose, orange-red or "tomato-red", often exceeding the persistent calyx, 2.5 - 3.5 mm in diameter, glabrous, smooth.

Specimens examined

QUEENSLAND: *Bancroft 5343,* Eidsvold, July 1917 (NSW). *Barnard s.n.*, Yarraman, 9.vii. 1941 (BRI 052343). *Beasley 7,* Chinchilla, 3.v. 1912 (BRI). *Bell 591,* Coalstoun Crater, Burnett district, lat. 25° 36', long. 150° 53', Aug. 1972 (BRI). *Blake 4747,* Goodna, 10.iv. 1933 (BRI). *Boorman s.n.*, Acacia Creek near Killarney, Feb. 1905 (AD, BRI 190719, G, S, SYD). *Boorman s.n.*, Warwick, March 1911 (F, NSW 135910). *Cameron 41,* Yarraman, 13.xi. 1933 (A, BRI). *Carey s.n.*, Goodna, May 1930 (SYD). *Clemens 43762,* Crows Nest, 24.ii. 1944

(A). *Clemens s.n.*, Yarraman, Aug. 5-15, 1944 (A, NY). *Clemens s.n.*, Jericho, March 1946 (BRI 190990). *Cunningham* 78, Brisbane river, Oct. 1824 (K lectotype; K 2 spec., W). *Darnell-Smith s.n.*, Parlardo-Chinchilla, April 1926 (NSW 135913). *Dietrich 132*, Rockhampton, undated (HBG). *Dietrich 1272, 1376, 1558, 1851, 2081*, loc. incert, undated (HBG). *Dietrich 1286*, Rockhampton, undated (HBG, WU). *Dookrill 522*, Atherton district, lat. 20° 05' S, long. 146° 55' E, 16.v. 1972 (BRI). *England, s.n.*, Kilcoy, Oct. 1919 (BRI 190714). *Everist s.n.*, Bendemere 10 miles N of Yuleba-Brigalow, 8.vii. 1951 (BRI). *Gittins 863*, Rockland Springs, ca. 22 miles S of Bluff, July 1964 (BRI). *Hubbard 5366*, near Boonah between Teviotville and Antony, 30.xi. 1930 (BRI, K 2 spec.). *R. W. Johnson 2639*, Fitzroy Basin, Brigalow Research Stn. 20 miles NW of Theodore, 25.iv. 1963 (BRI). *Kenny s.n.*, Gayndah, March & May 1913 (BRI 094268 & 190709). *Kenny s.n.*, Crows Nest, Sept. 1919 (BRI 190716). *Lazarides 6912*, 8 miles SW of Moura Township, 6.vii. 1963 (BRI, CANB, NSW). *Leichhardt s.n.*, Moreton Bay, 1.iv. 1844 (P, NSW 135909). *Leichhardt s.n.*, upper part of Castle Creek, 4.iii. 1847 (NSW 135912). *Leichhardt 80*, Condamine, 1849 (P). *Longman s.n.*, Toowoomba, presented ix. 1931 (K). *McDonald s.n.*, 72 Cockenzie, Dipperu National Park, lat. 21° 55', long. 148° 40', Aug. 1971 (BRI 129076). *McKee 10182*, Blackbutt, upper Brisbane Valley, 2.iv. 1963 (NSW). *Michael 1995*, Kalbar Rd near Boonah, 18.xii. 1933 (A, BRI). *F. Mueller s.n.*, Rockhampton, 1869 (GH, K, MEL). *F. Mueller s.n.*, Burnett River, undated (GH p.p., K). *F. Mueller s.n.*, Port Mackay, undated (GH). *F. Mueller s.n.*, Suttor River, undated (MEL). *Phillips 1218*, 4 miles from Yarraman in Cooyar logging area, 6.vi. 1961 (CBG). *Roe s.n.*, Table, Mt. Toowoomba, undated (BRI 052342). *Salisbury s.n.*, Mary River, April 1906 (CGE). *Shirley s.n.*, Nanango, undated (A). *Simmonds 375*, Goodna, 10.xii. 1889 (BRI). *Simmonds s.n.*, Wooroolin, Aprl. 1914 (BRI 190710 and 190711). *Simmonds s.n.*, Barmoya NE of Rockhampton, May 1937 (GH). *E. J. Smith s.n.*, Kalbar, S. of Ipswich, Sept. 1935 (BRI 190993). *L. S. Smith 591*, Kindon Stn., *ca.* 54 miles NNE of Goondiwindi, 7.xii. 1938 (BRI). *L. S. Smith 9871*, Bundaberg, lat. 240° 50', long. 152° 20', 13.vi. 1957 (BRI). *Tallegalla s.n.*, Mt. Morgan near Rockhampton, undated (BRI 190718). *Telford 903*, Kalpowar Forest, 24 miles NE of Monto, 26.v. 1969 (CBG). *Telford 3450*, 4 km SE of Kingaroy, 3.x. 1973 (CBG). *Thozet s.n.*, loc. incert., 1870 (G). *Webb & White 1134*, Wandoan, 1.vi. 1946 (BRI). *White s.n.*, Rosewood, Sept. 1911 (NSW 135914). *White s.n.*, loc. cit., May 1913 (BRI 190715). *White s.n.*, Wallumbilla, May 1916 (BRI 190713). *White s.n.*, Wyaga, Goondiwindi distr., Sept. 1919 (BRI 190708). *White s.n.*, Bunya Mt, Oct. 1919 (AD, BRI 190706 & 190707). *White 884*, Goodna, 4.viii. 1922 (A). *White 10785*, Callide Valley, Apr. 1937 (BRI). *White 12399*, Enniskillen, 14.xi. 1943 (A, BRI). *Wilson 729*, 40 miles SW of Bundaberg, 13.vi. 1957 (BRI, US). *Young s.n.*, Barakula, undated (BRI 190705).

NEW SOUTH WALES: *Beadle s.n.*, near Bingara, June 1947 (SYD). *Beckler, s.n.*, Macleay river, undated (K). *Blaxwell 263, Pickard & Hayes s.n.*, Pikapene S.F., W of Casino, 20.iv. 1969 (NSW 130591). *Boorman s.n.*, Sandiland Ranges, Nov. 1904 (BR, NSW 135908, W 3939). *Boorman s.n.*, Mt Danger, Gungal, Sept. 1905 (NSW 135920). *Boorman s.n.*, Narrabri, June 1907 (G, GH, NSW 135917, NY). *Boyd & McGillivray 2036*, 0.2 mile E Esk River and 5.5 miles NNW Iluka, 27.vi. 1966 (NSW). *Burgess s.n.*, Razorback Mt. near Camden, 15.i. 1962 (CBG 009500). *Burgess s.n.*, Owen's Gap, 8.viii. 1963 (CBG 002946). *Burgess s.n.*, loc. cit., west of Scone, 13.viii. 1969 (CBG 03170). *Cambage s.n.*, Pokolbin near Cessnock, 25.viii. 1910 (SYD). *Clark, Pickard & Coveny 1758*, ca. 39 miles E of Liston, *ca.* 25 miles NW of Tabulam, 26.vii. 1969 (BRI, NSW). *Cleland* s.n., Scone, 1.iii. 1917 (AD 97608108). *Clements s.n.*, Palisthan via Condobolin, Feb. 1892 (NSW 135922). *Clements s.n.*, Port Macquarie, Apr. 1894 (NSW 135915). *Constable 78*, Unumgar Stn., 18.iv. 1947 (NSW). *Coveny s.n.*, Gloucester, Apr. 1966 (NSW 135918). *Coveny 4136 & Biaby s.n.*, 12.7 km WNW of Scone, lat 32° 01' S, long. 150° 45' E, 27.iii 1972 (NSW). *Cunningham 491*, "Nova Hollandia", undated (W syntype). *Cunningham s.n.*, interior of NSW., 1817 (W syntype). *Cunningham 247*, Hamilin's Valley, 9.viii. 1817 (K syntype). *Cunningham s.n.* in Herb. Endl. & Herb. Hook., Nova Hollandia, undated (K, W syntypes). *Forester s.n.*, Hadleigh, near Warialda, Aug. 1912 (NSW 135916). *Gandoger s.n.*, loc. incert., June, 1906 (MO 117716). *Johnson 23444*, Mt. Dangar, S. of Gungal, 10.iv. 1953 (MO, NSW, US). *Johnson & Constable 42207*, Pickapene State forest, 5 miles N Busby's Flat, WSW of Casino, 8.vi. 1957 (NSW). *Julius 5513/17*, Ticketty Wells, July 1917 (NSW). *Maiden s.n.*, Scone, Aug. 1899 (NSW 135919). *Maiden s.n.*, Bruschy Mts., Sept. 1897 (G). *McAuliffe 2566/12*, Casino, May 1912 (NSW). *McBarron 15077*, Razorback Mt. near Camden, 6.iv. 1968 (NSW). *McBarron 15491*, loc. cit. 3.viii. 1968 (NSW). *McKee 639*, near Mt. Dangar, 10.iv. 1953 (SYD). *Mitchell 517*, Nova Hollandia, Aug. 1846 (K). *Salasoo 1801*, on banks of Page River, between Gundy and Scone, 4.x. 1959 (NSW). *Schrader s.n.*, loc. incert., 1855 (LE). *Stafford s.n.*, Denman, 26.v. 1945 (NSW 135921). *Story 7121*, *ca.* 2 miles of Jerry's Plains, 19.iii. 1960 (BRI, CANB, NSW). *White 12562*, Toonumbar, near Kyogle, 14.iii. 1944 (A, BRI).

Fig. 2. *Spartothamnella juncea* (A. Cunn. ex Walp.) Briq. *(C. Burgess* s.n.: CBG 009500). A, flowering twig; B, flower with bract and bracteoles; C, flower with calyx and corolla vertically cut open showing andreocium and gynaeceum; D, ovary; E, T.S. ovary; F, fruit with persistent calyx; G, back view of undehisced anther; H, front view of undehisced anther; I, back view of dehisced anther; J, front view of dehisced anther, showing the single chamber formed by the confluent anther-lobes at the apex.


1 mm
E
3 mm
F
1 mm
D
6 mm
C
1mm
G
1mm
H
1mm
J
1mm
I
10cm
A
7 mm
B

Distribution (Map 2)

S. juncea is endemic in Queensland and New South Wales. The major distribution is in the eastern parts of these states where this species is restricted chiefly between lat. 20° and 35° S. and between long. 146° and 153° E. The Queensland localities are mainly in the South-eastern part of the state, occurring chiefly to the east of long. 149° E. A few scattered collections are made from south-south-east of Townsville in the north, and from the north of Charleville towards the interior of the state.

In New South Wales, this species is restricted chiefly to the north-eastern part of the state. Most of the localities are to the north-west and north-east of Newcastle towards the Queensland border. Elsewhere, two collections are made from near Camden to the south-west of Sydney and one from north-west of Condobolin at Palisthan. (See Addendum at end of paper.)

Comments

The lectotype duplicate in Herb. W is annotated (probably by Cunningham himself) as *"Spartothamnus ephedraeoides* A. Cunn". A habit sketch of this with analytical drawing of flower and its parts is also preserved in Herb. W (Icon. no. 168). It bears the above-mentioned species name as well as the family name "Myoporineae" under which this species was originally published. The name *"Spartothamnus ephedraeoides* A. Cunn.", however, is not known to have been validly published.

Moldenke (1959, 1971) recorded this species from New Zealand, but there is no collection to confirm this and the genus is believed to be endemic to mainland Australia. He seems to have followed F. Mueller (Fragm.6 (1868) 153), who erroneously considered *Teucridium parvifolium* Hook.f., from New Zealand, as a species of this genus under the name *"Spartothamnus hookeri"*.

Maiden noted on his collection (no. NSW 135919) from Scone, New South Wales, that the stem attained 3 inches (i.e. ca. 7.5 cm) in diameter at the base, which is very much larger than any other recorded.

Dietrich's collection (no. 132) in Herb. HBG has two labels with different localities. One of them refers this specimen to Port Mackay and the other to Rockhampton. Since there is only one specimen on this herbarium sheet and the species is now known to occur in both the above named localities, it is difficult to assign this collection to either of these localities with certainty. Nevertheless, this species is much more frequent around Rockhampton, and Dietrich did name another collection of this species (no. 1286 in Herb. HBG and WU) from this locality. It is, therefore, thought likely that this specimen also came from Rockhampton.

This species is popularly known as "Goodnight Scrub".

Affinity

S. juncea is closely allied to *S. teucriiflora* in having pedicellate flowers and calyx shorter than corolla. However, it can be easily identified by its stem, leaves, pedicels and calyx being glabrous and stem very acutely 4-angled and distinctly longitudinally striate.

3. Spartothamnella teucriiflora (F. Muell.) Mold., Phytologia 1 (1940) 430; Black, Fl. S. Aust. 4, 2 ed. (1957) 725; Mold., Resume Verben. etc. (1959) 210, 345; Blackall & Grieve, W. Aust. Wildlfs 3 (1965) 567; Beard (ed.), W. Aust. Pl. 2 ed. (1970) 114; Mold., Fifth Summary Verben. etc. 1 & 2 (1971) 348, 622, 623; Chipp., Proc. Linn. Soc. NSW. (1971) 256.

Type: Rev. H. Kempe 438, near the Finke River, Northern Territory, 1882 (MEL 68887, lectotype; MEL 68886).

Spartothamnus teucriiflorus F. Muell. in Wing (ed.), South Sc. Rec. 2 (1882) 55 Basionym; F. Muell., Syst. Cens. Aust. Pl. 1 (1882) 102; Kempe, Trans. R. Soc. S. Aust. 5 (1882) 22; Tate, Trans. & Proc. R. Soc. S. Aust. 12 (1889) 113; F. Muell., Sec. Syst. Cens. Aust. Pl. 1 (1889) 171; F. Muell. & Tate, Trans. R. Soc. S. Aust. 13 (1890)

105; Tate, Fl. Extratrop. S. Aust. (1890) 156, 254; Tate, Trans. R. Soc. S. Aust. 15 (1892) 262; F. Muell. & Tate, Trans. R. Soc. S. Aust. 16 (1896) 375; Tate in Spencer (ed.), Horn Sc. Exped. 3 (1896) 174; Diels & Pritzel, Bot. Jahrb. 35 (1904) 513; Ewart & Davies, Fl. N. Terr. (1917) 239 in obs.; Domin, Mem. Soc. Sc. Boheme (1923) 106; Black, Fl. S. Aust. 1 ed. (1926) 483; Gard., Enum. Pl. Aust. Occ. 3 (1931) 111; Black, Trans. R. Soc. S. Aust. 60 (1936) 172; Beard (ed.), W. Aust. Pl. 1 ed. (1965) 93.

Type: As for *Spartothamnella teucriiflora* (F. Muell.) Mold.

Typification

S. teucriiflora was originally described on two collections, one by Rev. H. Kempe (no. 438) from the Northern Territory and the other by E. Giles (s.n.) from Western Australia. Kemp's collection (no. 438, 3 spec.) has flowers and fruit, but Giles' collection (s.n., 2 spec.) has a few young flowers only. Therefore, a specimen of Kempe's collection no. 438, preserved in Herb. MEL, seems to be the better representative of this species and is, therefore, selected here as the lectotype.

Description

A much branched semi-scandent shrub to 1.5 metre high. *Branches* green, slender, rigid, obtusely 4-angled, grey-puberulous when young, later almost glabrous and leafless. *Leaves* caducous, sessile, linear-lanceolate or narrowly ovate-lanceolate, entire, (5-) 7 - 15 (-25) mm long, (1-) 2 - 3 (-4) mm broad, glabrous (and glutinous) above, pubescent below. *Flowers* axillary, solitary or 2 - 3 on a short axillary peduncle, pedicellate; pedicel 3 - 5 mm long, slender, grey-pubescent; bracts ± leafy, sessile, linear or linear-lanceolate, 3 - 5 (-7) mm long, 1 - 2 mm broad, grey-pubescent below (i.e. on the outer surface), glabrous above (i.e. on the inner surface); bracteoles persistent, sessile, linear, (1-) 1.5 - 2 mm long, 0.3 - 0.5 mm broad. *Calyx* deeply 5-lobed, 4 - 6 (-7) mm long, grey-pubescent outside, glabrous within; lobes lanceolate, spreading, longer than the tube, (2-) 3 - 4 (-5) mm long, 1 - 1.5 mm broad at the base; tube (1-) 1.5 - 2 mm long. *Corolla* creamy-white, 8-11 mm long, puberulous outside, villous in the throat; anterior-lobe ± elliptic, 5 - 7 mm long, 3 - 4.5 mm broad; the other 4-lobes almost equal, ± oblong-ovate, 3 - 4 (-5) mm long, 2 - 3 mm broad; tube (2-) 3 - 4 mm long. *Stamens* 4, much exserted, the anterior two filaments 8 - 10 mm long, the posterior (or lateral) two 7 - 8 mm long; anthers reniform, somewhat glandular at the back, ± 1 mm long, 0.5 mm broad. *Ovary* ± globose, faintly 4-lobed in the upper half, ± 1 mm in diameter, glabrous, sparsely glandular at the top; style much exserted, filiform, 9 - 13 mm long, glabrous. *Fruit* globose, green when young, later orange-red or somewhat blackish, often exceeding the open persistent calyx, 3 - 4 (-5) mm in diameter, glabrous, smooth and shiny.

Specimens examined

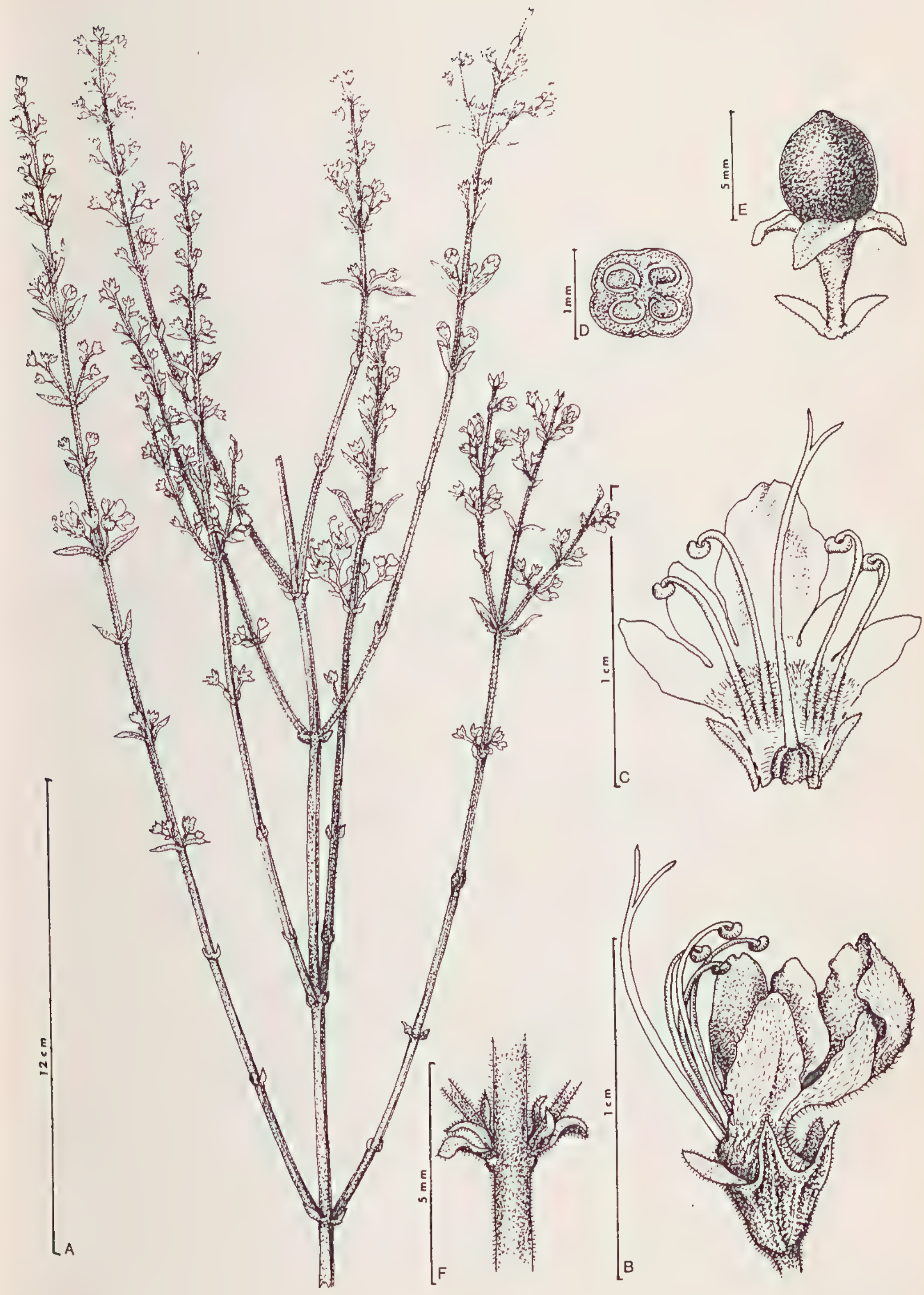
NORTHERN TERRITORY: *Chippendale 1767*, ¼m. E. no. 2 Desert Bore, Hamilton Downs, 24.ix. 1955 (AD, BRI, NT, NSW, PERTH). *Chippendale 2013*, 3 m. SW no. 2 Desert Bore, Hamilton Downs, 12.iv. 1956 (NT). *Chippendale 2904*, 6 m. E. Mt Olga, 13.ix. 1956 (AD, BRI, NT). *Chippendale 6236*, Turrawurra Bore, 34½ m. WSW Haasts Bluff, 22.vi. 1959 (NT). *Chippendale 6281*, ca. 20 m. S Glen Edith, 25.vi. 1959 (AD, BRI, NT). *Cleland s.n.*, 16 km NE of Ayers Rock, 13.vi. 1935 (AD). *Cleland s.n.*, 50 km NE of Ayers Rock, 10.vi. 1935 (AD). *Cleland s.n.*, Yuendumu, 17.viii. 1951 (AD). *Cleland s.n.*, Burt Plain N of Mt Hay, 31.viii. 1951 (AD). *Cleland s.n.*, Haast's Bluff Reserve, 21.viii. 1956 (AD). *Cleland s.n.*, north of Mt Hay, 16.viii. 1957 (AD). *Dietrich s.n.*, Charlotte Waters, 1885-6 (LE). *George 4977*, 26 m. NW of Mt Olga, 11.vii 1963 (PERTH). *Hill & Lothian 810*, 3 m. N of Mt Olga, 4.vii. 1958 (AD, NT). *Kempe 438*, near the Finke River, 1882 (MEL lectotype; MEL 2 spec.). *Latz 141*, 87 m along Harts Range Road, 10.ii. 1968 (NT). *Latz 2403*, Petermann Ranges, 24° 47' S, 129° 32' E, 11.iv. 1972 (AD, CANB, NT, PERTH). *Lazarides 5768*, 36 m. NNW of Alice Springs, 21.viii. 1956 (AD, BRI, CANB, NSW, NT, PERTH, US). *Lazarides 6099*, 7 m. W of Aileron Township, 30.ix. 1956 (AD, BRI, CANB, NT). *Maconochie 1826*, ca. 2 m N Ayers Rock, 25° 19' S, 131° 03' E, 27.viii. 1973 (CANB, NT, MO). *Munir 5144*, Mt Olga, 24.viii. 1973 (AD). *Nelson 351*, Burt Plain, 36 m. N Alice Springs, 13.vii. 1962 (CANB, NT). *Nelson 445*, Aileron Lagoon, 77 m. N Alice Springs, 3.viii. 1962 (AD, BRI, CANB, NT, PERTH). *Nelson 573*, Burt Plain, loc. cit., 13.xii. 1962 (NT). *Nelson 605*, loc. cit., 6.iii. 1963 (NT). *Nelson 737*, loc. cit., 13.v. 1963 (NT). *Nelson 865*, loc. cit., 6.i. 1964 (NT). *Swartz & Schultz 30*, near the Finke River, Gosses Range, undated (MEL). *Swartz s.n.*, loc. cit., 1885 (MEL). *Swinbourne 533*, Burt Plain, 30.x. 1962 (CANB, NT). *Tietkens s.n.*, loc. incert., 4.vi. 1889 (AD). *Winkworth 1122*, 16 m. N Alice Springs, 2.v. 1955 (NT, NSW).

SOUTH AUSTRALIA: *Forde 489*, 50 m. E of Emu, 4.ix. 1956 (CANB). *Helms s.n.*, Arckaringa Valley, 21.v. 1891 (AD). *Kuchel 437*, ca. 275 km N of Coober Pedy, 13.viii. 1962 (AD). *Perry 5517*, 22 m. S of De Rose Stn., 12.ix. 1955 (BRI, CANB, NT, US). *Shaw 459*, ca. 16 km E of Tieyon Homestead, 10.x. 1966 (A, AD). *Tate s.n.*,

between Mt Stuart and Mt Boothby, ca. 20 km E of Beltana, May, 1891 (AD). *Weber 2853*, Durkin Out Stn., ca. 15 km W of Mulgathing, 27.ix. 1971 (A).

WESTERN AUSTRALIA: *Aplin 2451*, 37 m. E of Meekatharra, 23.viii. 1963 (PERTH). *Ashby 4225*, S. of Meekathara, 7.viii. 1971 (PERTH). *Beard 3518*, 3 m. S of Warroora Stn., 20.vii. 1964 (PERTH). *Beard 4378*, Kennedy Range near old Merlinleigh Homestead, *ca.* 80 m. NE of Carnarvon, 23.viii. 1965 (PERTH). *Bennett 105*, Wongawol Stn., July, 1941 (PERTH). *Chinnock 825*, near James Pool, Windidda Stn., 6.ix. 1973 (AD). *Chinnock 952*, 16 km SW of Earaheedy Homestead, 10.ix. 1973 (AD). *Cumming s.n.*, Ernest Giles Range, 27° 03' S, 124° 06' E, 18.iii. 1892 (AD, NSW). *Drummond s.n.*, Swan River, 1843 (P). *Fitzgerald s.n.*, Nannine, near Mt Magnet, Sept. 1903 (NSW 135930, PERTH). *Gardner 2270*, Boolardy Stn., Murchison River, July 1927 (PERTH). *Gardner s.n.*, loc. cit. July 1927 (PERTH 2 spec.). *Gardner 2270*, Cue, 13.viii. 1931 (PERTH 3 spec.). *Gardner 3277*, Barrabiddy Hills, Minilya River, 31.viii. 1931 (PERTH). *George 702*, Ca. 31 m. S of Mt Magnet, 16.iv. 1960 (PERTH). *George 2509*, Cape Range road to no. 4 Well, 2.vi. 1961 (PERTH). *George 2810*, ca. 1 m. S of Laverton, 23.viii. 1961 (PERTH). *George 4543*, between White Cliffs and Ivor Rocks, E of Laverton, 1.vii. 1963 (PERTH). *George 5359*, 12 m. W of Todd Ranges, Gunbarrel Hwy., 24.vii. 1963 (PERTH). *Giles s.n.*, between the Murchison and Gascoyne Rivers, undated (MEL 2 spec. syntypes; AD photo). *Goodall 852*, 22 km from Mt Magnet, Geraldton Road, 9.iii. 1963 (PERTH). *Green 1619*, 34 m. E of Mt Magnet, 27.viii. 1957 (PERTH). *Helms s.n.*, near Mt Squires, 28.viii. 1891 (AD). *Helms s.n.*, Victoria Desert, camp 40 Eld. Expl. Exped., 4.ix. 1891 (AD 2 spec., K, NSW 135927-28). *Ince 8102*, loc. incert., 1909-10 (PR); *Ince s.n.*, loc. incert., 23.vi. 1908 (k 2 spec.). *Maiden s.n.*, Laverton, Sept. 1909 (NSW 89902 & 135926). *Melville 133*, Boolardy Stn., 1936 (K, PERTH). *Moore s.n.*, Goldfields, June 1895 (NY). *Phillips s.n.*, 5 m. from Menzies towards Kalgoorlie, 7.ix. 1968 (CBG 038558, NSW, PERTH). *Royce 10433*, 65 m. N of Sandstone towards Wiluna, 15.x. 1972 (PERTH). *Speck 1088*, 22 m. N of Meekatharra, 27.vii. 1958 (CANB, PERTH). *Staer s.n.*, Nanine, Oct. 1905 (E). *Weber 4766*, ca. 2 km N of Leonora, 19.ix. 1975 (AD). *Wilson 7548*, Edjudina Stn., *Ca.* 130 km NNE of Kalgoorlie, 31.viii. 1968 (PERTH). *Wittwer 1148*, Meekatharra — Cue road, 25.viii. 1973 (PERTH).

Fig. 3. *Spartothamnella teucriiflora* (F. Muell.) Mold. (A-D, A. M. Ashby 4225: PERTH; E-F, P. K. Latz 2403: AD). A, flowering twig; B, flower; C, flower with calyx and corolla cut open showing androecium and gynaeceum; D, T. S. ovary; E, fruit with persistent calyx; F, opposite bracts with bracteoles.


12 cm
A
1 mm
D
5 mm
E
1 cm
C
5 mm
F
1 cm
B

Distribution (Map 3)

S. teucriiflora is by far the most wide spread species of the genus, occurring chiefly in the eremean parts of the Northern Territory, South Australia and Western Australia. In the Northern Territory, it is restricted to the southern part between lat. 22° and 26° S and between long. 129° and 135° E. The main localities are to the west-north-west of Alice Springs, and to the east-north-east of the Petermann Ranges. There are also two disjunct localities, at Harts Range and near Charlotte Waters.

There are a few scattered localities in the far north of South Australia. Two of these are to the north-west of Tarcoola in the Victoria Desert, one to the east of Beltana and the remaining to the north of Coober Pedy towards the Northern Territory border.

In Western Australia, this species is widespread to the north-north-east of Perth between lat. 22° and 32° S. and between long. 113° and 128° E. The major distribution is in the Eremean Province* excepting a solitary collection from along the Swan River in the South Western Province. Within the Eremean Province, most of the localities are in the Ashburton and Austin districts, one in the Coolgardie district and a few in the southern half of the Carnegie district. Equatorially, the distribution in the Eremean Province extends from Exmouth Gulf in the west up to the Barrow Range in the east. (See addendum at end of paper).

Comments

Flowers of *S. teucriiflora* are the largest in the genus, measuring 8 - 11 (-13) mm in length.

Domin (1923) and Black (1936) erroneously spelt this species "S. teucriifolius" and "S. teucriifolia" respectively.

A discrepancy exists in Gardner's collection 2270 (PERTH) which consists of four herbarium sheets. Three of them, annotated in the collector's hand were gathered from Webb's Patch, Cue, and are dated "13 July, 1931". The other, in an unidentified hand, is labelled as being from "Boolardy Station, Murchison River", and is dated "July 1927". The latter probably belongs to a different collection because its two duplicates in Herb. PERTH are unnumbered.

Affinities

S. teucriiflora is closely ralated to *S. juncea* in the majority of its flower characters. Nevertheless, it is readily distinguished by its stems being rather obtusely 4-angled and non-striate and by the young branches, pedicel and calyx being grey puberulous.

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Note: *The Botanical Provinces and Districts of Gardner & Bennetts (1956) are used to record the distribution in Western Australia.

Map 3: Distribution of *Spartothamnella teucriiflora*.

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Index to Collections

Collectors' names are in alphabetical order, and their numbers (in Arabic numerals) are followed by the numbers (in Roman numerals) given below to each species. T represents holo- or lecto- type of the species indicated.

Spartothamnella puberula = I

S. juncea = II

S. teucriiflora = III

Althofer s.n., I. — *Aplin* 2451/III. — *Ashby* 4225/III. — *Bencroft* 5343/II. — *Bernard* s.n./II. — *Barton* 230/I. — *Beadle* s.n.,/II. — *Beard* 3518/III; 4378/III. — *Beasley* 7/II. — *Beckler* s.n./II. — *Bell* 591/II. — *Bennett* 105/III. — *Biaby* s.n./II. — *Bick* BRI 190721/I; BRI 190722/I; NSW 134923/I. — *Blake* 4747/II. — *Blaxell* 263/II. — *Boorman* s.n./I; s.n./I; s.n./II; NSW 135908/II; NSW 135917/II; NSW 135920/II; W 3939/II. — *Bowman* s.n./I. — *Boyd & McGillivray* 2036/II. — *Burgess* CBG 002946/II; CBG 009500/II; CBG 031170/II. — *Cambage* s.n./II. — *Cameron* 41/II. — *Carey* s.n./II — *Chinnock* 825/III; 952/III. — *Chippendale* 1767/III; 2013/III; 2904/III; 6236/III; 6281/iii. — *Clark, Pickard & Coveny* 1758/II. — *Cleland* AD 97608108/II; s.n./III; s.n./III; s.n./III; s.n./III; s.n./III; s.n./III. — *Clemens* BRI 070166/I; 43762/II; s.n./II. — *Clements* NSW 135915/II; NSW 135922/II. — *Constable* 78/II. — *Coveny* 4136/II; NSW

135918/II. — *Cumming* s.n./III. — *Cunningham* s.n./II; 78/IIT; 246/I; 247/II; 491/II. — *Cunningham & Milthorpe* 2520/I. — *Darnett-Smith* s.n./II. — *Dietrich* 132/II; 1272/II; 1286/II; 1376/II; 1558/II; 1851/II; 2081/II; s.n./III. — *Dockrill* 411/I; 522/II. — *Domin* 3025/I; 3132/I; 3181/I; 8101/I. — *Drummond* s.n./III. — *England* s.n./II. — *Everist* 3091/I; s.n./II. — *Fitzgerald* NSW 135930/III; s.n./III. — *Forde* 489/III. *Forester* NSW 135916/II. — *Gandoger* MO 117716/III. — *Gardner* 2270/III; 3277/III; s.n./III. — *George* 702/III; 2509/III; 2810/III; 4543/III; 4977/III; 5359/III. — *Giles* s.n./III. — *Gittins* 863/II. — *Goodall* 852/III. — *Green* 1619/III. — *Helms* s.n./III; s.n./III; s.n./III. — *Hill & Lothian* 810/III. — *Hubbard* 5366/II. — *Ince* 8102/III; s.n./III. — *Johnson* 2639/II; 23444/II. — *Johnson & Constable* 42207/II. — *Julius* 5513/II. — *Kempe* 438/IIIT. — *Kenny* s.n./II. — *Kuchel* 437/III. — *Latz* 655/I; 1930/I; 2403/II. — *Lazarides* 5768/III; 6099/III; 6912/II. — *Leichhardt* 80/II; s.n./II. — *Longman* s.n./II. — *Maclean* s.n./I. — *Maconochie* 1826/III. — *Macuean* 1/I. — *Maiden* NSW 135919/II; s.n./II; s.n./III. — *McAuliffe* 2566/II. — *McBarron* 15077/II; 15491/II. — *McDonald* s.n./II. — *McKee* 639/II; 10182/II. — *Michael* 1995/II. — *Mikee* 10345/I. — *Mitchell* 517/II. — *Moore* s.n./III. — *F. Mueller* s.n./IT; s.n./I; s.n./II. — *Munir* 5144/III. — *Nelson* 351/III; 445/III; 573/III; 605/III; 737/III; 865/III. — *Perry* 5517/III. — *Phillips* 1218/II; CBG 038558/III. *Pickard & Hays* NSW 130591/II. — *Rat* s.n./I. — *Roe* s.n./II. — *Royce* 10433/III. — *Salasoo* 1801/II. — *Salisbury* s.n./II. — *Schrader* s.n./II. — *Shaw* 459/III. — *Shirley* s.n./I; s.n./II. — *Simmonds* 375/II; s.n./II. — *Smith, E. J.* s.n./II. — *Smith, L. S.* 9871/II. — *Speck* 1088/III. — *Staer* s.n./III. — *Stafford* NSW 135921/II. — *Story* 7121/II. — *Swartz* s.n./III. — *Swartz & Schultz* 30/III. — *Swinbourne* 533/III. *Tallegalla* s.n./II. — *Tate* s.n./I; s.n./III. — *Telford* 903/II; 3450/II. — *Thozet* s.n./II. — *Tietkens* s.n./III. — *Weber* 2853/III; 4766/III. — *Webb & White* 1134/II. — *White* 9461/I; 884/II; 10785/II; 12020/I; 12399/II; 12400/I; 12562/II; BRI 190706/II; BRI 190707/II; BRI 190708/II; BRI 1907013/II. — *Wilson* 729/II; 7548/III. — *Winkworth* 1122/III. — *Wittwer* 1148/III. — *Young* BRI 190705/II.

Addendum

The following data, based on material in Herb. MEL, became available while this paper was in press. Only specimens of major distributional importance are listed.

S. puberula (F. Muell.) Maid. & Betche

WESTERN AUSTRALIA: *Willis s.n.*, N. declivities of Mt Bruce, Hamersley Range National Park, 17.viii. 1974 (MEL 68882).

NORTHERN TERRITORY: *Willis s.n.*, Inner N. rock Walls of Gosse's Bluff, south of MacDonnell Ranges, ca. 160 km W.S.W. of Alice Springs, 26.vii. 1966 (MEL 68883). *Swartz s.n.*, Finke River, 1885 (MEL 68881). *Swartz & Schultz 30*, near the Finke River, Gosse's Range, undated (MEL 68880).

QUEENSLAND: *Birch s.n.*, Alice River, 1883 (MEL 68878). *Biddulph s.n.*, Mt Playfair, 1891 (MEL 68903).

NEW SOUTH WALES: *Musson s.n.*, Namoi River, 1890 (MEL 68877).

Comments

J. H. Willis' collection from Mt Bruce, Hamersley Range, is the first record of *S. puberula* from Western Australia. This locality is nearly 1460 km west of its previously known range.

S. juncea (A. Cunn. ex Walp.) Briq.

QUEENSLAND: *Bourn 280*, Head of the Isaac River, undated (MEL). *Hartman 127*, Boyne, 1873 (MEL). *F. Mueller s.n.*, Warwick, undated (MEL 68849).

NEW SOUTH WALES: *Carson s.n.*, Marthaguy Creek, July 1890 (MEL 68865). *Musson 53*, Narrabri, Namoi River, 1890 (MEL). *Musson 592*, Peel River, 1890 (MEL). *Woolls s.n.*, near Mudgee, 1872 (MEL 68857-9).

S. teucriiflora (F. Muell.) Mold.

WESTERN AUSTRALIA: *Helms s.n.*, Skirmish Hill, 22.vii. 1891 (MEL 68893). *F. Mueller s.n.*, Hemelin Harbour, Oct. 1877 (MEL 68896).

Comments

F. Mueller's collection from Hemelin Harbour is the only record of this genus from the far south-west of Western Australia.

Index to scientific names

Page numbers in **bold** type refer to main taxonomic treatment, those in *italics* indicate synonyms and misapplied names. Numbers with round brackets ( ) indicate key.

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STUDIES IN AUSTRALIAN LAMIACEAE
1. THE GENUS *WRIXONIA* F. MUELL. (PROSTANTHEROIDEAE)

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Abstract

The genus *Wrixonia* comprises two species, *W. prostantheroides* F. Muell. from Western Australia, and *W. schultzii* (F. Muell. ex Tate) Carrick, comb. nov. from Northern Territory, for each of which a lectotype is chosen. A key is provided to distinguish the genus from the five other genera recognized in the Prostantheroideae. Both species are described and figured, and because of the very meagre original diagnosis, a more complete Latin description of the second is given.

The genus *Wrixonia*, established by F. Mueller in 1876, was so called in honour of Henry John Wrixon, for many years Minister of Justice in Victoria, and scholarly patron of the Arts and Sciences.

The material was collected by Jess Young in 1875, during the Giles Expedition, in the vicinity of Mount Churchman, Western Australia, and Mueller named the plant *W. prostantheroides* because of its resemblance to the genus *Prostanthera* Labill. in having entire calyx lips and a similar odour. The two upper stamens, however, are sterile, which distinguishes *Wrixonia* from *Prostanthera* in which all four stamens are fertile, and from *Microcorys* and *Westringia* in which the two lower stamens are sterile.

Mueller himself, however, expressed some doubt as to the validity of his new genus: "Planta, si intra Prostantheram inclusa, P. Wrixoni dicenda". Total or partial sterility of some or all anthers, and the presence or absence of appendages on the connectives, are major criteria in the separation of the genera of Prostantheroideae. Although a better knowledge of the range of variation within the genera may lead to a more natural grouping, it is, for the time being, considered justifiable to uphold Mueller's decision.

In 1886, from the summit of Mount Sonder, Northern Territory, Rev. W. F. Schwarz of the Hermannsburg Lutheran Mission collected vegetative specimens of a plant which Mueller annotated *Prostanthera schulzii*, presumably in honour of Pastor Louis Schulze, also of Hermannsburg. Mueller recorded it in his Census supplement 4 in 1889, as *P. schulzii*, and again in his Second Census in 1889, but with a change in spelling, as *P. schultzii*. There was an M. Schultz who collected in the Darwin area in the 1860s, but apparently he had no connection with L. Schulze, according to J. H. Willis in Victorian Naturalist, 86 (1969) 132. It is possible that Mueller confused them, though there appears to be no evidence of any connection between them.

Further collections from Mount Sonder, also not in flower or fruit, were made by Professor R. Tate in 1894 during the Horn Expedition. He listed it in a paper entitled "A Supplement to a Census of the Flora of Extra-Tropical South Australia" in Trans. R. Soc. S. Aust. 19 (1895) 82, retaining the "t". These three references are nomina nuda. In his "Account of the Botany of the Horn Expedition" (1896) 173, Tate cites Mueller's Second Census and quotes from correspondence with Mueller: "Differs from *P. rotundifolia* R. Br. in smaller, less crenate and thicker leaves", adding that flowers and fruit remain unknown, thus validating the specific epithet.

Cuttings sent to the Royal Botanic Gardens, Melbourne, in 1967, flowered in 1968. Because of the sterile upper stamens, Willis (loc. cit.) suggested that it belonged to the genus *Wrixonia*. The excellent flowering and fruiting material collected from Mount Sonder in 1972 (J. R. Maconochie 1653), because of its completeness, has been of particular value, and forms the basis of the present description.

The following key distinguishes *Wrixonia* from the other genera recognized in the Prostantheroideae. (Fig. 1).

1. Four stamens fertile 2
   Two stamens fertile 4
2. Anthers 2-celled; connective prominent at back, usually cristate and produced into 1 or 2 linear appendages .... *Prostanthera*
   Anthers 1-celled; connective elongated and produced beyond its insertion on the filament 3
3. Connective produced into a small tooth-like or shortly linear appendage .... *Hemiandra*
   Connective produced into a sterile branch which in the upper pair is usually short and dilated, and crested or bearded at the end, in the lower pair (rarely in both pairs) is glabrous and attentuate or bearing an imperfect cell at the end .... *Hemigenia*
4. Lower stamens fertile, anthers 2-celled, without appendages; upper stamens sterile, bearing very small club-shaped heads .... *Wrixonia*
   Upper stamens fertile, anthers 1-celled; lower stamens sterile, anthers reduced to a small connective with 2 linear or linear-clavate branches *5*
5. Connective of the fertile stamens elongated, produced below the insertion on the filament into a short lower branch usually dilated and bearded at the end. .... *Microcorys*
   Connective of the fertile stamens not, or very shortly, produced below the insertion on the filament .... *Westringia*

WRIXONIA F. Muell.

F. Muell., Fragm. 10 (1876) 18; Durand, Gen. Phan. (1888) 329; Briquet, in Engler & Prantl, Naturl. Pflanzenfam. 4, 3a (1895) 219; Dalla Torre & Harms, Gen. Siphon. (1904) 435, no. 7224; Blackall & Grieve, W. Austral. Wildfl. 3 (1965) 575.

Intricately branched woody shrubs, up to 2 m high, leaves less than 1 cm long. *Inflorescence* racemose or spicate, more or less compact, terminal on short branchlets. *Bracts* broad, membranous. *Bracteoles* narrow-linear to narrow-lanceolate, well-developed or obsolescent, caducous. *Calyx* 2-lipped, 10-nerved, lips entire or somewhat sinuate, almost equal or the upper broader, closed in fruit. *Corolla* white, tube cylindric, expanded at the throat, upper lip deeply 2-lobed, lower lip deeply 3-lobed, the lobes broad, rounded and more or less emarginate. *Stamens* more or less exserted, lower pair fertile, 2-celled, upper pair sterile, with small, more or less club-shaped heads. *Ovary* glabrous, deeply 4-cleft, style slender, gynobasic, shortly bifid. *Nutlets* reticulate, attachment obliquely basal.

Type species: Wrixonia prostantheroides F. Muell.

Leaves deflexed, with undulate margins; inflorescence a raceme, more or less condensed 1 *prostantheroides*
Leaves spreading, more or less flat, margin thickened; inflorescence a very condensed spike .... 2 *schultzii*

1. W. prostantheroides F. Muell., Fragm. 10 (1876) 18; Cens. Austral. Pl. (1882) 101; Sec. Cens. Austral. Pl. (1889) 170; Briquet, in Engler & Prantl, Naturl. Pflanzenfam. 4, 3a (1895) 219; Gardner, Enum. Pl. Austral. Occid. (1931) 114; Beard, West Austral. Pl. (1965) 94; Blackall & Grieve, W. Austral. Wildfl. 3 (1965) 575.

Typus: J. Young s.n., "in vicinia montis Churchmani", 27.x.1875, MEL 502314, lectotypus hic designatus. Young's collection is now mounted on two sheets, MEL 502314

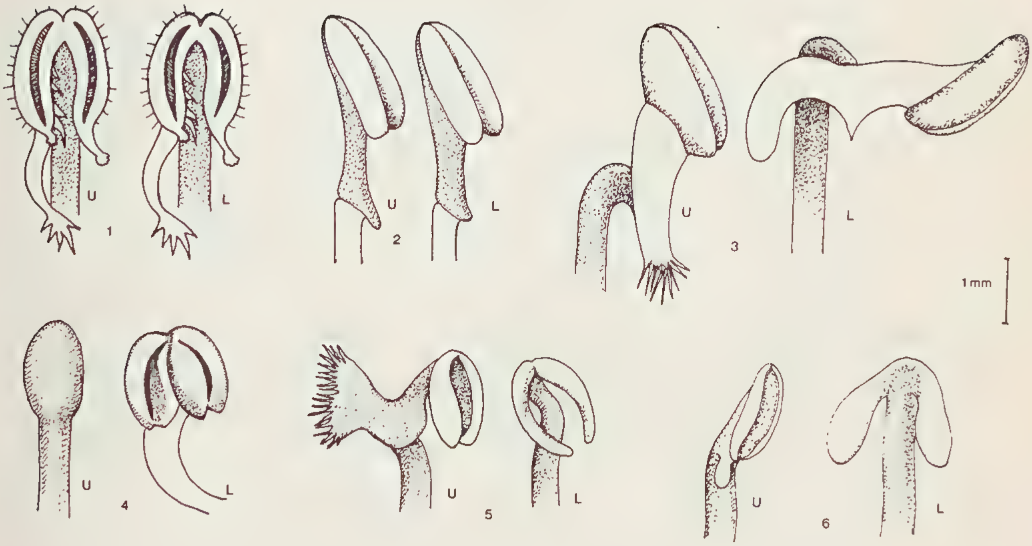

Fig. 1. Anthers of the genera of Prostantheroideae: U = upper, L = lower. 1, *Prostanthera lasianthos* Labill.; 2, *Hemiandra pungens* R. Br.; 3, *Hemigenia westringioides* Benth.; 4, *Wrixonia prostantheroides* F. Muell.; 5, *Microcorys obovata* Benth.; 6, *Westringia grevillina* F. Muell.

and MEL 502315. Both contain several twigs almost devoid of leaves and flowers and packets containing loose leaves and flowers.

Intricately branched undershrub up to 50 cm high, branches more or less patent and somewhat terete, ultimate branchlets short and spinescent, stems, leaves and calyces outside short white hairy or nearly glabrous, with small, sessile, circular glands. *Leaves* sessile or very shortly petiolate, cordate, rhomboid or orbicular, 1-4 mm long, deflexed, with undulate margin, concave above. *Inflorescence* terminal; lowest floral leaves gradually transformed distally into broad lanceolate or oblanceolate to ovate bracts, 2.5-5 mm long and 1.5-4.5 mm broad, membranous, caducous, concave, glabrous above, hairy below and on the margin or almost glabrous; pedicels 1-4mm long, more or less flattened; bracteoles narrow-linear to narrow-lanceolate or oblanceolate, 3-4 mm long, 0.1-1 mm broad, caducous. *Calyx* 2- lipped, tube 3-3.5 mm long, obconic, about 2.5 mm diameter at throat, upper lip broadly ovate to almost circular, about 3.5 mm across, sometimes obscurely and shallowly 3-lobed, lower lip almost circular to oblong, about 3 mm across, entire or slightly emarginate, after flowering folding upwards against the upper lip to close the throat. *Corolla* white, purple-spotted in the throat, tube almost 7 mm long and 2 mm in diameter, expanding slightly towards the throat, upper lip deeply 2-lobed, lobes oblong, 3-3.5 mm long and 2-2.5 mm broad, entire, lower lip deeply 3-lobed, lobes broadly elliptic, more or less emarginate, middle lobe about 5 mm across, lateral lobes about 4 mm long and 3 mm broad. Lower *stamens* fertile, slightly exserted, filaments thick, about 3 mm long, attenuated upwards, attached at the throat of the corolla, anthers about 1 mm long, dorsifixed, connective prominent, without appendage, cells oblong, divergent, longitudinally dehiscent, stamens sterile, enclosed, reduced to slender filaments about 1 mm long, attached in the upper part of the corolla tube and bearing small club-shaped heads. *Ovary* deeply 4-lobed, style slender, gynobasic, shortly bifid. *Nutlets* very obliquely attached, ellipsoid, about 2 mm long and 1 mm diameter, the anterior usually slightly smaller, silvery, reticulate-pitted, minutely colliculate, the epidermis eventually separating from the nutlets. (Fig. 2).

Distribution

WESTERN AUSTRALIA: Eremean Province, Austin and Coolgardie Districts: *A. M. Ashby 2992,* near Pindar, 3.ix. 1969 (AD, PERTH); *5222,* half-way between Perenjori and the Inland Highway, 31.viii. 1975 (AD, B, CANB, E, G, GH, K, MEL, NT, PR); *5255,* SW. of Paynes Find, 14.vi. 1975 (AD, CANB, MEL, PERTH). *W. E. Blackall 697,* Pindar, E. of Mullewa, 20.ix. 1931 (PERTH). *Y. Chadwick 1839,* 176 km from Mt Magnet on Geraldton Road, 15.viii. 1963 (PERTH). *A. J. Cough 75,* Mt Gibson, 9.ix. 1963 (PERTH). *H. Demarz 30,* 16 km S. of Paynes Find, 13.v. 1968 (PERTH, Kings Park); *4352,* approx. 217 m.p. Paynes Find Rd, 20.viii. 1973 (Kings Park). *C. A. Gardner 2616,* near Pindar, 16.vii. 1931 (PERTH); *11992,* Paynes Find, xi. 1951 (PERTH). *A. S. George 4147,* Niagara, near Kookynie, 30.viii. 1962 (PERTH). *A. W. Humphries P29,* 25 miles NE of Morawa, 16.ix. 1951 (PERTH). *K. Newbey 2587,* Niagara Dam, 13.ix. 1966 (PERTH). *G. M. Storr s.n.,* 12 miles NW of Wialki, 4.x. 1958 (PERTH). *J. Z. Weber 4773,* 1 km SW of Niagara Dam, *c.* 50 km NE of Menzies, 20.ix. 1975 (AD, CANB, K, MEL, NT); *4774,* ibid. (AD, B, CANB, E, G, GH, MEL, NT, PR); *4802, c.* 5 km W of Niagara Siding, *c.* 50 km NE of Menzies, 20.ix. 1975 (AD, CANB, MEL, NT). *E. Wittwer 1348,* 71 m Sandstone-Paynes Find Rd, 10.viii. 1974 (Kings Park). *J. Young s.n.,* near Mt Churchman, 27.x. 1875 (MEL 502314, 502315). (Fig. 4).

2. W. schultzii (F. Muell. ex Tate) Carrick, comb. nov.

Prostanthera schultzii F. Muell. ex Tate, Bot. Horn Exped. (1896) 173, basionym; [F. Muell., Cens. Austral. Pl. Suppl. 4 (1889) 4, nomen ("P. schulzii"); Sec. Cens. Austral. Pl. (1889) 169, nomen; Tate, Trans. R. Soc. S. Aust. 19 (1895) 82, nomen]; Ewart & Davies, Fl. N. Terr. (1917) 239.

Typus: R. Tate s.n., "summit of Mount Sonder, June, 1894", MEL 43620, lectotypus hic designatus. All the material seen by Mueller and Tate is sterile. There is no evidence that Tate saw the Schwarz specimens in Melbourne. A portion of Tate's collection was sent to Mueller (MEL 43620) whose reply was quoted by Tate when the epithet was validated. The portion of Tate's collection seen by Mueller is therefore chosen as lectotype.

Fig. 2. *Wrixonia prostantheroides* F. Muell. 1, habit; 2, bract; 3, calyx after flowering; 4, corolla opened to reveal stamens; 5, front and back view of anther; 6, longitudinal section of fruit to show closed calyx; 7, nutlet.

Frutex intricate ramosus, usque ad 2 m altus, ramulis foliisque glabris, glandulis circularibus minutis dense omnino tectis. *Folia* petiolo 1-2 mm longo, conduplicato, amplexicauli, inter nodos decurrenti, lamina fere orbiculari, 4-8 mm diametro, crassa, concolora, integra vel interdum retusa, margina incrassata. *Inflorescentia* terminalis, perbreviter pedunculata, spiciformis, vix 1 cm longa lataque, constans ex 10-16 floribus sessilibus decussatis spississimis superpositis. Bractea late obovata, truncata, concava, membranacea, margine integra, 3-4 mm longa, 2.5-3 mm lata, extus pilis brevibus albis crispis in dimidio inferiore tecta, intus glabra. Bracteolae duo basi calycis affixae, membranaceae, anguste oblanceolatae, circa 2 mm longae, 0.5 mm latae, extus pilis parcis tectae, intus glabrae. *Calyx* bilabiatus, glandulis circularibus minutis sparse tectus;

Fig. 3. *Wrixonia schultzii* (F. Muell. ex Tate) Carrick. 1, habit; 2, bract; 3, flower at anthesis; 4, corolla opened to reveal stamens; 5, front and back views of anther; 6, longitudinal section of fruit; 7, nutlet.

tubo circa 2 mm longo, obconico, labiis latis truncatis imbricatis integris vel interdum sinuatis; labio inferiore circa 1.5 mm longo, 3.5 mm lato; labio superiore circa 2 mm longo, 5 mm lato. *Corolla* alba, glabra; tubo cylindrico, circa 4 mm longo, 1 mm diametro, fauce ampliato, lobis plus minusve patentibus; labio superiore circa 2 mm longo, 4 mm lato, bilobo, lobis integris; labio inferiore trilobo, lobo medio circa 3 mm longo latoque, subermarginato, prope medium 2 maculis purpureis et faucem luteum versus 4 maculis elongatis luteis praedito, lobis lateralibus integris, circa 2.5 mm longis, 2 mm latis, quoque 1 macula purpurea prope angulam inferiorem interiorem praedito sed sine maculis luteis. *Stamina* inferiora duo fertilia, exserta, fauce inserta, filamentis crassis, circa 3 mm longis, antheras versus attentuatis, antheris ellipticis, 0.7 mm longis, 0.5 mm latis, dorsifixis, sine appendiculis, longitudinaliter dehiscentibus; stamina superiora duo sterilia, inclusa, filamentis gracilibus, circa 1 mm longis, claviformibus, sine antheris. *Ovarium* profunde lobatum, stylo gynobasico, tenui, circa 7 mm longo, breviter bifido. *Nuculae* oblongae, 2 mm longae, 1 mm latae, bruneolae, reticulatae, valde oblique affixae.

Ob materiam exiguam sterilemque typi, hanc descriptionem atque tabulam a materia Maconochiei 1653 paravi.

Intricately branched shrub up to 2 m high, branchlets and leaves glabrous, densely covered with minute circular glands. *Leaves* petiolate, petiole 1-2 mm long, conduplicate, clasping, decurrent, lamina almost circular, 4-8 mm diameter, thick, concolorous, entire or sometimes retuse, margin thickened. *Inflorescence* terminal, very shortly pedunculate, spicate, scarcely 1 cm long and broad, consisting of 10-16 decussately arranged, closely overlapping, sessile flowers; flower subtended by a broadly obovate, truncate, entire, concave, membranous bract, 3-4 mm long, 2.5-3 mm broad, clothed with short, white, curled hairs on the lower half outside, glabrous inside; bracteoles attached at the base of the calyx, narrowly oblanceolate, membranous, about 2 mm long, 0.5 mm broad, sparsely hairy on the outside, glabrous inside. *Calyx* two-lipped with a few circular glands outside, tube obconical, about 2 mm long, lips broad, truncate, imbricate (the upper overlapping the lower), entire or sometimes sinuate, lower lip about 1.5 mm long, 3.5 mm broad, upper lip about 2 mm long, 5 mm broad. *Corolla* white, glabrous, tube cylindrical, about 4 mm long, 1 mm diameter, expanding at the throat, lobes of the lips spreading, upper lip about 2 mm long, 4 mm broad, 2-lobed, lobes entire, lower lip 3-lobed, middle lobe about 3 mm long and broad, slightly emarginate, near the middle provided with 2 purple spots and towards the yellow throat with 4 elongated yellow spots, lateral lobes entire, about 2.5 mm long, 2 mm broad, each provided with 1 purple spot near the lower interior angle, but without yellow spots. Lower *stamens* fertile, exserted, attached at the throat, filaments thick, about 3 mm long, attenuated upwards, anthers broadly elliptical, 0.7 mm long, 0.5 mm broad, dorsifixed, without appendages, opening in longitudinal slits, upper stamens sterile, included, filaments slender, about 1 mm long, club-shaped, without anthers. *Ovary* deeply 4-lobed, style gynobasic, slender, about 7 mm long, shortly bifid. *Nutlets* oblong, 2 mm long, 1 mm broad, pale brown, reticulate, very obliquely attached. (Fig. 3).

Distribution

NORTHERN TERRITORY: Mount Sonder: *A. C. Beauglehole 27455*, 22.ix. 1968 (BEAUGLEHOLE, AD). *G. Chippendale s.n.*, 10.ix. 1958 (NT 4836, AD, BRI, CANB, K, MEL, NSW, PERTH). *J. R. Maconochie 1650, 1653*, 5.x. 1972 (NT, AD). *W. F. Schwarz s.n.*, 1886 (MEL 43619, 43621). *R. Tate s.n.*, Horn Expedition, 27.vi. 1894 (AD 97601077, MEL 43620). *J. H. Willis s.n.*, 20.vii. 1966 (MEL 43617). (Fig. 4).

Acknowledgements

I am indebted to Dr J. P. Jessop and Dr Hj. Eichler for their interest and criticism, to Dr J. H. Willis, formerly of the National Herbarium, Melbourne, who has examined living material of *W. schultzii*, for assistance in the preparation of the Latin description and to Mr L. Dutkiewicz for the drawings.

Fig. 4. Distribution of *Wrixonia prostantheroides* (dots) and of *W. schultzii* (triangle).

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"CLARET ASH" *FRAXINUS OXYCARPA* BIEB. EX WILLD. CV. RAYWOOD: ITS ORIGIN IN SOUTH AUSTRALIA

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Bean (1973) places the Australian ash cv. Raywood under the binomial *Fraxinus oxycarpa* Bieb. ex Willd. (syn. *F. angustifolia* Vahl ssp. *oxycarpa* (Bieb. ex Willd.) Franco & Rocha Afonso). There is also the comment that after its origin in Australia, cv. Raywood was introduced into commerce in Britain by Messrs. Notcutt of Woodbridge, Suffolk soon after 1925 when they received bud-wood. They used the name *F. excelsior* L. var *raywoodii* Hort., but also donated this cultivar to Kew in 1928 as *F. excelsior* L. var. *wollastonii* Hort. The brown winter buds and leaves of cv. Raywood suggest that it is *F. oxycarpa* and not *F. excelsior* which, as is well known, has black winter buds. In *Flora Europaea* 3: 54 (1972), *F. oxycarpa* is treated as a subspecies of *F. augustifolia* with the synonyms *F. pojarkoviana* V. Vassil., and *F. syriaca* sensu Hayek, non Boiss.

My colleague, Mr. D. Francis, has drawn my attention to a letter written by Mr. E. Stirling Booth to the Director of the Melbourne Botanic Garden, Mr. A. W. Jessep on March 12, 1949, and in which details of the origin of cv. Raywood are given. "Claret Ash" is now a well known tree in places like Adelaide and Canberra so that its origin is worth recording.

About the year 1910, Mr. T. C. Wollaston noticed and purchased a plum-coloured foliage form of ash amongst a row of seedlings reputed to have been of Austrian origin, but also reputed to have contained plants of the North American species *F. nigra* Marsh. These plants were growing in Sewell's Nursery at Aldgate in the Adelaide Hills, the nursery now being owned by Messrs. Kemp. Wollaston himself owned the Ray Nursery adjacent to his property called 'Raywood' near Bridgewater where the original tree was planted in 1910 by his gardener, Mr. J. Gates. Stirling Booth spoke to Gates on March 12, and the gardener stated that he had not seen fruits on the tree in his time. In 1949 the original tree was 40 feet high, standing to the west of the house in the property renamed 'Arbury Park' by its new owner Mr. A. R. Downer, onetime Australian High Commissioner to Britain. A number of daughter plants had also by this time become established, the first having been grafted by Gates onto *F. ornus* L. and being about the same size as the original tree, others planted in a row and having been budded onto *F. excelsior* by Gates. Mr. Downer's property is now used by the South Australian Education Department as a conference centre. Most of the early material of cv. Raywood was distributed from the Ray Nursery which was closed in the 1940's.

The appearance of purple autumnal tints in the cultivar, presumably by mutation, either with or without attendant hybridisation, is understandable because it is not unique in the genus. Bean (1929) quotes Sargent as saying that *F. longicuspis* Siebold & Zuccarini from Japan has foliage which in autumn changes to a purple colour, but whether he referred to the apetalous type, or the petalous plants now referred to *F. sieboldiana* Blume, (Ohwi, 1965), cannot be said. Rehder (1960) also includes *F. americana* L. as having yellow or purple autumnal tints, depending on physiological conditions, while *F. americana* L. forma *iodocarpa* Fern. from N. America, and *F. mariesii* Hk.f. from C. China, both have purple coloured fruits.

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MORPHOLOGICAL VARIATION AND TAXONOMY OF *ISOETES MUELLERI* A. BR.

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Abstract

Characters used in *Isoetes* L. taxonomy are examined for the *I. muelleri* A. Br. complex. The characters examined in detail include general morphology (based on field studies as well as dried specimens), stomata, megaspore form, size and ornamentation, sporangial characteristics and cytology.

Three classes of megaspore types are defined for species of *Isoetes* producing polymorphic megaspores.

A polyploid series in *I. muelleri* was noted with somatic chromosome numbers of 22, 44, and 55 recorded. This species is considered to be apomictic.

These studies indicate that *I. muelleri* is an exceptionally variable species occurring in a wide range of habitats throughout Australia. *I. stuartii* A. Br. is shown to be synonomous with *I. muelleri*.

Introduction

Isoetes muelleri was described by Alexander Braun in 1868 on the basis of a collection from near Rockhampton, Queensland. This species remained almost unknown, except for the original description, until Aston (1973) recorded it from the Northern Territory, South Australia, Victoria, Western Australia and Queensland. However, Aston did not discuss this or other Australian species in detail, and since Braun (1868) there has been no critical review of the Australian taxa of *Isoetes*.

I. muelleri belongs to a small group of Australian species, which also includes *I. humilior* and *I. stuartii*, characterized by the presence of vela covering the sporangia. Within this group *I. humilior* F. Muell. ex A.Br. (=*I. hookeri* A. Br.) and *I. stuartii* A. Br. differ from *I. muelleri* in only a few features (Braun, 1868; Pfeiffer, 1922) and their taxonomic status is reviewed. In this paper, characters used in *Isoetes* taxonomy are examined for the *I. muelleri* complex.

Materials and Methods

Both fresh and dried materials were examined. Collections and voucher specimens made during this study are lodged at AD. Plants were grown either submerged in a large glass tank or in a wet house with daily mist watering.

Megaspores were examined by light and scanning electron microscopy. Megaspore diameter measurements were made using dry spores, loose on microscope slides. Spores for scanning electron microscopy were fixed to small circular glass coverslips with a synthetic rubber adhesive, placed in an enclosed glass chamber and exposed to the fumes of 2% osmic acid solution overnight. This pretreatment helped reduce charging of specimens during examination (Pfefferkorn, 1970). The coverslips were then glued onto S.E.M. stubs and coated with pure gold in either an evaporative or sputter coating unit.

Specimens were examined and photographed using an ETEC Autoscan fitted with an NEC secondary X-ray detector and analyser.

Large root-tips from short, young, unbranched roots were used for chromosome preparations. The root-tips were pretreated with 20 ppm chloro-I.P.C. for 4 hours at

room temperature. This caused chromosome contraction in the same way as described for I.P.C. (Storey and Mann, 1967). Colchicine was found to be ineffective on the *Isoetes* species studied.

The pretreated root-tips were fixed in 3:1 absolute ethanol: glacial acetic acid for 20 minutes, and transferred to a mixture of approximately 0.2% cellulase and 0.5% pectinase in phosphate buffer at pH 5.2, and left overnight to soften the cell walls and intercellular pectins. This facilitated squashing of the root-tip cells. After a brief wash in 45% acetic acid, squash preparations were made from the root-tips in lacto-propionic orcein (Dyer, 1963). This procedure yielded well stained chromosomes with less cytoplasmic and background staining than with aceto-orcein or aceto carmine stains.

General Morphology

I. muelleri is variable in form (fig. la-g), ranging from tall, erect, flaccid, aquatic plants (fig. la) to small amphibious plants (fig. lg) with spreading, usually turgid leaves. Between these extremes a wide range of intermediates can be found, including tiny grass-like plants (fig. lf) which grow in dense clumps. All plants shown in figures la-f bore sporangia containing mature megaspores.

The size of plants, however, varies within individual populations. Figure 2a-d shows a range of plants collected from within a few centimetres of each other. Each plant bore mature sporangia, and most of the variation in size between them appeared to be due to age differences rather than environmental effects since all plants were found growing together in the centre of a shallow swamp.

Culturing of plants has shown that leaf habit varies under differing growth conditions. Terrestrial plants normally have only spreading leaves, whilst aquatic plants mostly have erect, flaccid leaves. When plants with spreading leaves were grown in water, new leaves grew erect. At Naas Creek in the Snowy Mountains spreading plants *(Marsden 178B)* were found growing on the banks of the stream, whilst erect specimens *(Marsden 178A)* of apparently the same species were growing below permanent water level. When plants from each habitat were cultured together in the laboratory they were indistinguishable except for size, the plants from the banks being generally smaller. Small grass-like specimens of *I. muelleri* from rock pools in central and southern Australia also grew erect when submerged and rather spreading when grown in wet soil.

Despite this morphologic plasticity, at least some of the variation between populations appears to be genetically based. Plants from ephemeral shallow rock pools in central Australia (e.g. fig. le) and plants from ephemeral swamps in south-eastern Australia remained distinct from plants from permanent water in the Snowy Mountains and Tasmania, even when grown under the same conditions for two years. Those from less permanent water remain smaller, with fewer, more slender leaves. These plants grow from late autumn to spring and die off to a resting stage in the corm during summer. Those from permanent waters remain green all year round, shedding the old sporophylls as they are pushed off by new growth. Plants from the ephemeral conditions can be kept green all year round if submerged in permanent water, although they usually lose most of their leaves during the late summer and autumn.

Despite the differences between the extremes of form shown by plants included in *I. muelleri*, there is almost complete intergradation from one extreme to the other (fig. la-g).

Fig. 1 Variation in plant size and habit of *I. muelleri* from several localities, scale = 10 cm.a. *Marsden 177;* b. *Beauglehole 47901 B;* c. *Marsden 178B;* d. *Marsden 39;* e. *Beauglehole 45893;* f. *Beauglehole 36218;* g. *Marsden* 150.


G
F
E
D
C
B
A

Lobing of the corm

The corm-like stems of *Isoetes* usually bear 2 or 3 (occasionally 4 or more) deep furrows along their length resulting in a lobing of the corm.

In the type description (Braun, 1868), *I. muelleri* was described as having a three lobed corm. However, in this study populations of *I. muelleri* have been found to contain from 5-50% bilobed plants. Taxonomic use of this character has thus led to considerable confusion in the classification of this species and bilobed specimens of *I. muelleri* have often been misidentified as *I. humilior.* Clute (1905) noted similar variation in lobing of some unspecified North American species. However, Pfeiffer (1922) considered the number of lobes of the corm to be characteristic for each species, with only a low frequency of deviation within species from the typical number of lobes.

Number of corm lobes was one of the key characteristics used by Braun (1868) to distinguish between *I. muelleri, I. stuartii* and *I. humilior,* but in view of the evidence for corm variation in *I. muelleri,* this feature is less distinctive than considered by Braun.

Stomata

Presence or absence of stomata on leaves of *Isoetes* is a character which has been traditionally correlated with habitat. Terrestrial and amphibious species always possess stomata whilst they are generally lacking in aquatic species, although there are some exceptions to this latter case (Pfeiffer, 1922). Consequently emergent and submerged plants of *I. muelleri* might be expected to possess and lack stomata respectively.

However, plants of *I. muelleri* have always been found to bear some stomata, at least on the apical portion of the leaves, even when growing permanently submerged. When emergent plants were transferred to aquatic conditions, the stomatal frequency was observed to diminish on the new leaves produced underwater.

The presence of stomata in *I. muelleri* and their absence in *I. stuartii* and *I. humilior* was another feature used by Braun (1868) to separate the species. However, plants recently collected from Tasmania (*Morris,* Elizabeth River) which otherwise corresponded to the description of *I. stuartii* were found to possess a few stomata on the apical portions of the leaves. Hence this feature also appears to be inconsistent and of doubtful taxonomic use for the separation of this species from *I. muelleri. I. humilior* appears consistently to lack stomata.

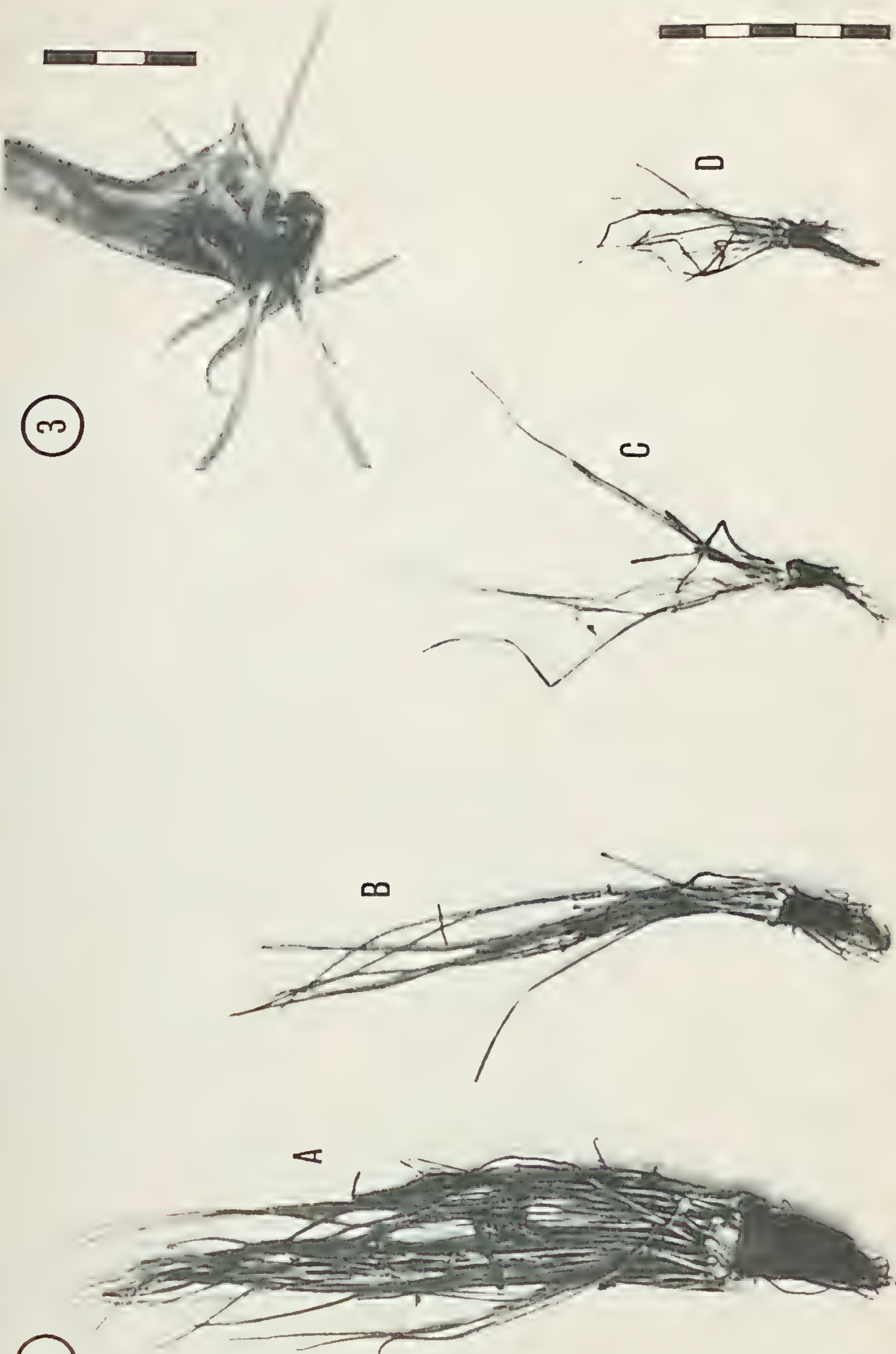
Megaspores

Megaspore ornamentation has been one of the most widely used taxonomic characters in *Isoetes.* The large size of these spores enables observation of gross ornamentation features using only relatively low magnifications such as are available with a hand lens. The advent of scanning electron microscopy has revolutionized examination of such spores, facilitating not only observations of gross ornamentation, but also study of the ultra-structure of the outer spore walls.

Polymorphism of megaspores within individual sporangia has been well documented for species from America (Jeffery, 1937), India (Pant and Srivastava, 1962; Goswami and Arya, 1970) and Africa (Hall, 1971). Goswami and Arya (1970) described the different spore forms as large, medium and small or, in the case of dimorphic spores, as large and small. Similar notation for megaspores was used by Hall (1971) and Marsden (1976). This terminology can lead to considerable confusion when discussing megaspores and can be misleading as the small megaspores of dimorphic types are analogous with the medium spores of a trimorphic type. Also the small megaspores of one species may be about equal in diameter to the large megaspores of another species which has normally diminutive spores.

Fig. 2. Range in plant size within a single population of *I. muelleri; Marsden 30,* scale = 5 cm.

Fig. 3. Young sporelings growing from within sporangium freshly removed from plant of *I. muelleri, Marsden 177,* scale = 3mm.



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The need is thus indicated for the adoption of acceptable terminology to define megaspore type and to ensure clarity in description. The following grouping system is proposed:

Type I megaspores (fig. 4)

Almost spherical in shape, nucleate and containing large quantities of fats and oils and other storage products; usually fertile.

Type IIA megaspores (fig. 4)

Somewhat flattened and usually triangular in outline, enucleate and almost totally devoid of storage compounds; infertile.

Type IIB megaspores (fig. 4)

Flattened and triangular in outline, enucleate, and lacking any storage compounds; infertile. (So far, recorded for only two species, *I. pantii* Goswami and Arya, and *I. indica* Pant and Srivastava).

Type III megaspores (fig. 4)

Irregular, dumb-bell shaped megaspores, usually appearing like parts of two Type I megaspores fused or joined together by one or more tubular connections, probably binucleate, and containing other storage products; possibly fertile. (Occur only in very low frequencies in sporangia containing Type I and Type IIA megaspores).

Type I megaspores are larger than, and quite distinct in shape from Type IIA megaspores whilst in any one species these are larger in turn than Type IIB megaspores Approximate relative sizes of the different megaspore classes are shown in figure 4. The actual size of Type I and Type IIA megaspores, however, varies greatly between species, e.g. the Type IIA megaspores of *I. coromandelina* L.f. (Marsden, 1976) may be as large as some of the Type I megaspores of *I. muelleri.*

Type IIA and Type IIB megaspores differ mainly in size and nature of the spore wall layers (Goswami and Arya, 1970). The size range of these spore types may, however, overlap in different species, e.g. Type IIB megaspores of *I. indica* may reach 380μm in diameter (Goswami and Arya 1970) while Type IIA megaspores from other species may also be in this size range. When the contents of individual sporangia from *I. indica* or *I. pantii* were examined it was found that the Type IIB megaspores occur as a distinct size group. Because of the similarities between the two smaller megaspore size groups from these species, they are classified as subgroups of one type (Type II) of megaspores. In species with only one megaspore type, this corresponds to the Type I megaspore group of species with polymorphic megaspores. Possible origins of the different megaspore types are discussed later in this paper.

Pfeiffer (1922), in her monograph on *Isoetes,* divided the genus into four sections — *Tuberculatae* Pfeiffer, *Cristatae* Pfeiffer, nom. illegit.*, *Echinatae* Pfeiffer, *Reticulatae* Pfeiffer — on the basis of megaspore ornamentation. De Vol (1972) proposed a fifth section, *Psilatae* De Vol, for species with smooth megaspores, but this name has not been validated by a Latin description as required under Article 35 of ICBN. Pfeiffer appears to have referred only to those megaspores classified here as Type I megaspores in her discussion as the size ranges given for some species, now known to have dimorphic megaspores, do not include the size range of the Type II megaspores (e.g. *I. coromandelina* and *I. muelleri).*

The megaspores of *I. muelleri* were described by Braun (1868) as covered with numerous, low, uneven tubercles, some of which were fused together into confluent ridges. Thus this species was placed by Pfeiffer (1922) into the section *Tuberculatae.* Examination of a wide range of specimens has revealed that *I. muelleri* megaspores are always dimorphic in size, with Type I and Type IIA megaspores, in approximately equal numbers, and occasional Type III megaspores occurring within individual sporangia.

*Pfeiffer's sectional name *Cristatae* is illegitimate as it contains the type species of the genus and following Article 22 ICBN must be named sect. *Isoetes.*

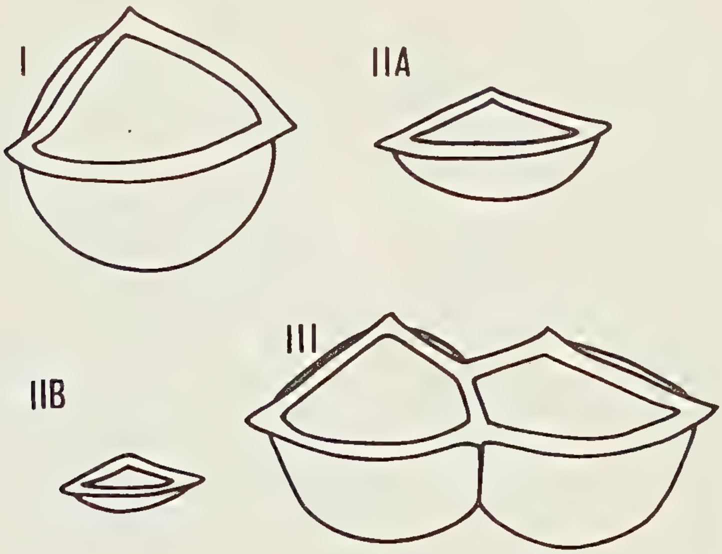


Fig. 4. Diagramatical representation of the relative sizes and shapes of Type I, Type IIA, Type IIB and Type III megaspores.

Type I megaspores, the only megaspore type previously described and discussed for this species, were found to be only very rarely tuberculate, with many specimens, including those from the nomenclatural type (fig. 11) showing only few tubercles, mainly on the proximal faces, and ridges of varying size and confluence (figs. 5, 7, 9, 11). Commissural and triradiate ridges of the spores are usually quite prominent, with the triradiate ridge usually somewhat broader and less raised than the commissural ridge. The range of Type I megaspores further includes spores showing irregularly confluent ridges only (fig. 13) through to others covered by a definite reticulate pattern (fig. 15). On the basis of this character alone, *I. muelleri* could be placed in any one of three different sections of the genus.

Similar infraspecific variation was recorded by Duthie (1929) for African species, and cases such as these cast serious doubt on the usefulness of this classification system for subdivision of *Isoetes*.

Type IIA megaspore patterning shows even wider variation than that of the Type I megaspores of *I. muelleri* (figs. 17-21) varying from almost smooth (except for the triradiate and commissural ridges) to closely reticulate.

Often there are wide differences between Type IIA megaspores from within individual sporangia of *I. muelleri* (figs. 19, 20).

Ornamentation of Type III megaspores (fig. 22) usually closely resembles that of Type I megaspores for that species.

Perispore of megaspores

The possible taxonomic usefulness of perispore structure of *Isoetes* megaspores examined using scanning electron microscopy was first demonstrated by Wanntorp (1970). Wanntorp found differences in perispore structure between species of *Isoetes* from south-west Africa, while Taylor et al (1975) found it was possible to separate two closely related species from North America on the basis of perispore structure.

The siliceous perispore of *I. muelleri* Type I megaspores is most commonly covered with minute, twisted spines (fig. 14) usually present in very great numbers (fig. 12, 16). In plants of a few collections, and in specimens corresponding to Braun's description of *I. stuartii,* these spines are poorly developed (fig. 8, 10), or scarcely present (fig. 6), however, an almost continuous range of variation between the two extremes has been found (see sequence figs. 6, 8, 10, 12, 14, 16).

In order to ensure that the observed variation is not simply due to megaspore age differences, a range of megaspores of different ages has been examined.

Normally when megaspores for scanning electron microscopy were chosen, they were initially examined using a light microscope, prior to preparation, and only mature spores were used. Immature spores either collapse when dried or have a pale translucent appearance when viewed in transmitted light. Therefore, a range of megaspores, from the youngest which did not collapse when dried but which were still obviously immature, to the oldest megaspores present on the plant, were examined from both plants which normally show few spines on the Type I megaspores as well as plants which have dense spinulose megaspore perispore surfaces. Results of this study are shown in figures 23-28.

Immature spores from plants with Type I megaspores showing poorly developed spines *(C. Marsden 177)* were examined and found to have an amorphous outer coating, which was shown by secondary X-ray analysis to contain considerable silica. Type I megaspores from sporophylls only two positions sequentially further out from the immature sporangia, were also examined. Although these megaspores were only slightly older they were found to have a perispore structure (fig. 25) almost identical with that of the oldest Type I megaspores on the plant.

Similar results were observed for specimens *(Beauglehole 52587)* which normally have spiny perispore surfaces. Figure 26 shows an immature spore with the early stages of formation of the small spines (fig. 27) visible in the perispore structure. The next oldest sporangium on the plant contained Type I megaspores with almost completely developed spines already present (fig. 28).

Since numerous leaves are produced and shed each season, age differences between sequential sporangia formed would be expected to be, at the most, only a few weeks. Thus the perispore patterning is apparently laid down very rapidly, after which almost no further perispore development takes place.

Perispore patterning of Type IIA and Type III megaspores of *I. muelleri* closely resembles that of the corresponding Type I megaspore in each individual plant.

Megaspore size

Megaspore size is a character used extensively by Pfeiffer (1922) in her key to species. Again, only those megaspores equivalent to Type I megaspores were considered by her.

Variation in size ranges of diameters of both Type I and Type IIA megaspores from several populations of *I. muelleri* are shown in figures 29, with the arithmetic mean, standard deviation from the mean and absolute size ranges indicated.

Figs. 5-10. Scanning electron micrographs of Type I megaspores of *I. muelleri.*

Fig. 5. Distal face of megaspore, *Marsden 178A*, scale = 200 μm.

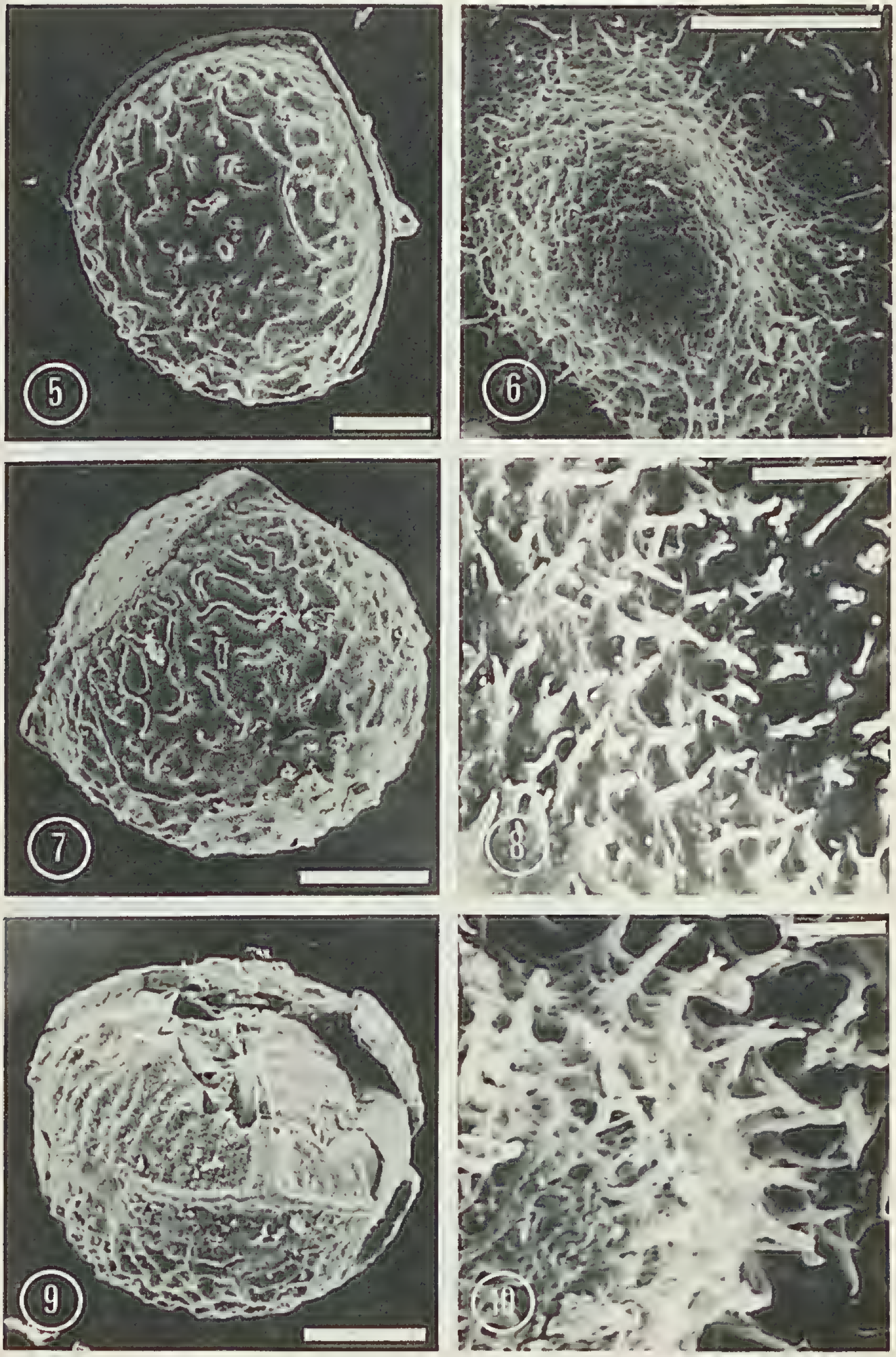
Fig. 6. Detail of surface of megaspore in fig. 5, scale = 20 μm.

Fig. 7. Distal face of megaspore, *Marsden 133*, scale = 200 μm.

Fig. 8. Detail of surface of megaspore in fig. 7, scale = 5 μm.

Fig. 9. Side view of megaspore, holotype *I. stuartii*, scale = 200 μm.

Fig. 10. Detail of surface of megaspore in fig. 9, scale = 5 μm.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Type I megaspores were found to vary from 560-750 μm *(Marsden 177)* down to 360-440 μm *(Seppelt,* Tassie Creek) in diameter whilst Type IIA megaspores varied from 380-520 μm *(Marsden 133)* to 250-320 μm *(Seppelt,* Tassie Creek) in diameter. Although the size range for Type I megaspores from one locality may fall within that of Type IIA megaspores from another, the differences in shape and contents are sufficient to distinguish between these spore types.

Megaspores of *I. muelleri* are much more variable in size than in any other species of *Isoetes* so far studied, e.g. megaspores of the two subspecies of *I. coromandelina*, are relatively similar, despite the occurrence of one subspecies in India and the other in Australia (Marsden, 1976). However, the continuous variation in size is indicated by the plot of size data in figure 29, with no discontinuities apparent.

Microspores

Formation of microspores by *I. muelleri* is very rare. In the range of material examined during this study only one small specimen, a plant grown in culture, from the south-east of South Australia *(Marsden 11)* was found to produce microspores. Prior to being placed in culture the plant appeared to have produced only megaspores, but no megasporangia were evident once production of microsporangia had begun. Unfortunately no mature microspores were obtained from this plant as it was fixed for examination of meiosis at an early stage of growth.

Velum

Braun (1868) described the velum of *I. muelleri* as complete and closed. However, whilst complete or almost complete coverage of each sporangium by a velum has been found most commonly, some specimens with only a half to a third of each sporangium covered have also been found.

In specimens with an incomplete velum, the extent of coverage of the sporangia was occasionally found to vary considerably on each plant, most often with narrower vela on the outer sporangia. Similar variation was also noted for a few specimens which corresponded to the description given for *I. stuartii,* which Braun (1868) described as having complete and closed vela. Plants identified as *I. humilior* were also found to have a complete velum in all specimens examined.

Sporangia

Sporangia in *I. muelleri* vary greatly in size from small (2 x 2 mm) in some of the smallest plants, to moderate sized (9 x 5 mm) in very large plants. Small sporangia contain only about 20-30 megaspores whilst the larger ones may contain as many as 200 or more.

The sporangia vary in shape from orbicular in the smaller sporangia to elliptic or obovate in the largest. The sporangial shape does not vary as greatly within individual specimens of the two sub-species of *I. coromandelina* (Marsden 1976).

Cells of the sporangial wall of *I. muelleri* are only infrequently pigmented as described by Braun (1868). This pigmentation was another feature used by Braun to differentiate *I. muelleri* from *I. stuartii* in which there is little pigmentation.

Figs. 11-16 Scanning electron micrographs of Type I megaspores of *I. muelleri.*

Fig. 11. Side view of megaspore, lectotype *I. muelleri*, scale = 200 μm.

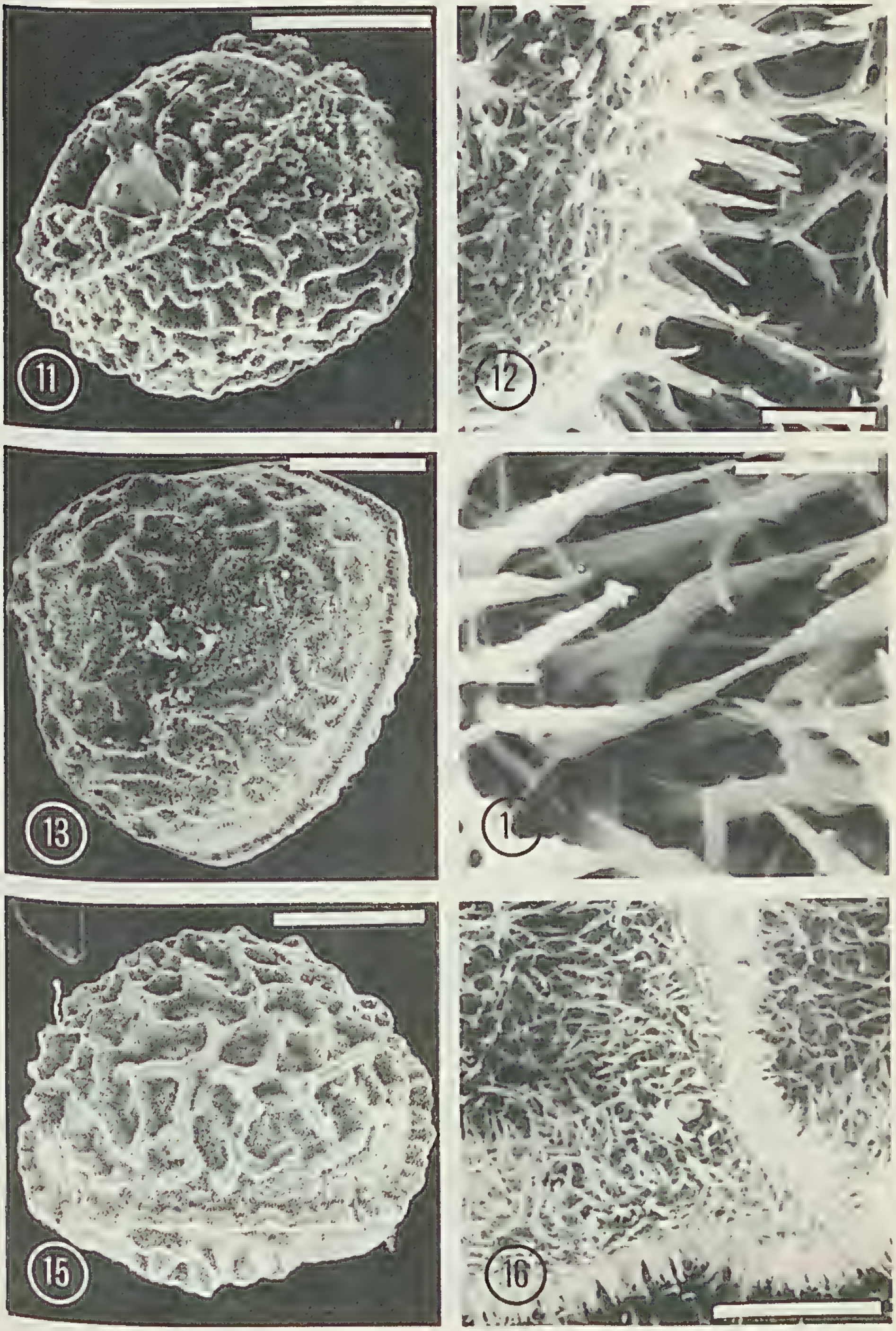
Fig. 12. Detail of surface of megaspore in fig. 11, scale = 5 μm.

Fig. 13. Distal face of megaspore, *Marsden 35*, scale = 200 μm.

Fig. 14. Detail of surface of megaspore in fig. 13, scale = 5 μm.

Fig. 15. Distal face of megaspore, *Beauglehole 44864*, scale = 200 μm.

Fig. 16. Detail of surface of megaspore in fig. 15, scale = 20 μm.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Cytology

Chromosome numbers published for *Isoetes* species have shown a remarkably constant base number of n = 11 with polyploids occurring in several species (Abraham and Ninan, 1958; Jermy, 1964; Pant and Srivastava, 1965; Matthews and Murdy, 1969; De Vol, 1972; Rychlewski and Jankun, 1972).

Chromosome counts have been made for several populations of *I. muelleri* and a partial polyploid series has been found. Diploid (2n = 22) *(Marsden 4)*, tetraploid (4n = 44) *(Marsden 177, 178A, 178B; Wollaston*, Marcollate Rocks; *Symons*, Carrappee Hill) and pentaploid (5n = 55) *Marsden 11, 31, 32, 39 Beaglehole 45893)* populations of *I. muelleri* have been noted, this being the first known record of pentaploids in the genus.

All chromosome counts have been based on observations of mitotic divisions. Meiosis has been observed only once in *I. muelleri* from a single pentaploid specimen which had been cultured in the laboratory *(Marsden 11)*. At metaphase univalents, bivalents, and multivalents were clearly visible.

Formation of Type I, Type IIA and Type III megaspores in all plants of *I. muelleri*, even in diploids, indicates that meiosis probably follows an irregular pattern such as that elucidated for *I. coromandelina* from India (Verma, 1960; 1961; Pant and Srivastava, 1965). This irregular meiosis leads to the production of chromosomally unreduced Type I megaspores and enucleate Type IIA megaspores from a mitotic-like division followed by a second cytokinesis (Verma, 1960; 1961). The origin of Type III megaspores has been discussed by Jeffery (1937) who considered that these dumb-bell shaped spores were the result of an abortive second division of meiosis. These spores would be binucleate. Pant and Srivastava (1965) described a possible origin for Type III megaspores which would result in one part being nucleate and the other part enucleate, i.e. much like a Type I and a Type II megaspore fused together. The exact nature of these spores in *I. muelleri* is not understood as only a limited amount of live material has been available, and cells undergoing meiosis have been difficult to find. If the large dumb-bell spores are binucleate, and in rare instances underwent fusion of these nuclei, germination of these spores could be a possible source of polyploids.

Type I, Type IIA and Type III megaspore production in diploid, as well as in polyploid plants of *I. muelleri* indicates that some mechanism besides polyploidy is inducing irregular meiosis and irregular spore production.

Apomictic germination of diploid Type I megaspores has been described by Jeffery (1937) and Pant and Srivastava (1965) for other species of *Isoetes*. Similar growth of Type I megaspores occurs in *I. muelleri* with numerous sporelings from the previous year's megaspores, often appearing in the soil around the base of mature plants at the start of each growth season, apparently with total lack of microspores. Growth of these sporelings could explain the origin of the very dense colonies of *I. muelleri* sometimes found in rock pools (e.g. on the summit of Ayers Rock in Central Australia).

Occasionally Type I megaspores may commence growth whilst enclosed within sporangia which are still attached to living plants (fig. 3). This is probably similar to the apomixis recorded by Sadebeck (1902) for *I. lacustris* L. and *I. echinospora* Dur. Germination of such spores in *I. muelleri* has only been noted in aquatic specimens, and it is noteworthy that both *I. lacustris* and *I. echinospora* are also aquatic species.

Figs. 17-22 Scanning electron micrographs of Type IIA and Type III megaspores of *I. muelleri*.

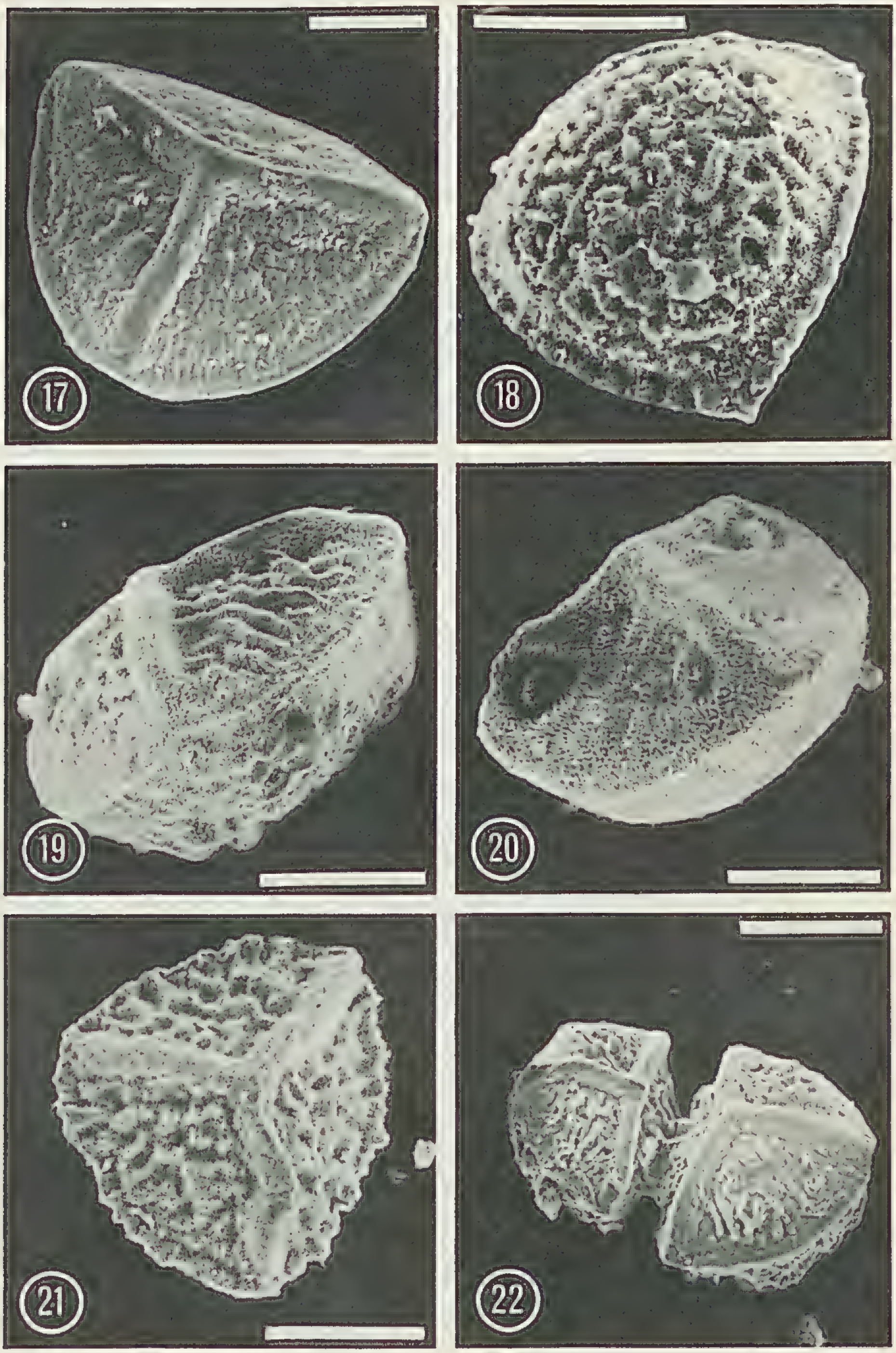
Fig. 17. Proximal faces of Type IIA megaspore, *Marsden 178A*, scale = 150 μm.

Fig. 18. Distal face of Type IIA megaspore, *I. muelleri* lectotype, scale = 150 μm.

Figs. 19, 20. Side views of type IIA megaspores, *Marsden 35*, scale = 150 μm.

Fig. 21. Proximal faces of Type IIA megaspores, *Beauglehole 44864*, scale = 150 μm.

Fig. 22. Proximal faces of Type III megaspores, *Marsden 178A*, scale = 300 μm.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The occurrence of polyploidy and apomixis in *I. muelleri* may largely explain the variation observed in this species, and the wide range of habitats colonized including cold sub-alpine waters, temperate, seasonal swamps in southern Australia, and ephemeral rock pools on granite outcrops in arid regions of central Australia.

Conclusions

Throughout the range of characters studied, *I. muelleri* shows very wide variation. However, no distinct infraspecific groups are apparent. Each character examined shows a more or less continuous range of variation which for many features exceeds the limits normally associated with individual species of *Isoetes.*

At one extreme of form of *I. muelleri* are large aquatic plants (fig. la) which have large sporangia and the largest megaspores, the perispore of which bear only a few spines (fig. 5, 6). At the other extreme are rather small, amphibious plants which have small to medium sized sporangia, contain small, or moderately sized megaspores reticulately ornamented (fig. 15) and densely covered with minute spines (fig. 16). The type specimen of *I. muelleri* fits between these two extremes.

I. humilior, is quite distinct from *I. muelleri,* having thick, rigid, dark leaves quite unlike any from the range of *I. muelleri;* corms of *I. humilior* have two rather elongated lobes whilst those of *I. muelleri* are compact and short; *I. humilior* produces only Type I megaspores, which are almost smooth, and also produces microspores; the leaf bases of *I. humilior* are thick and rigid, whilst those of *I. muelleri* are membranous and quite flexible. Thus, *I. humilior* on the basis of these features is retained as a distinct species.

I. stuartii, described by Braun (1868) in the same paper as *I. muelleri,* was distinguished on the basis of habitat, occurrence of stomata. lobing of the corm and colouring of the sporangial walls. All of these characters have been found to vary in *I. muelleri* as well as other features such as plant size and habit, sporangial characteristics and megaspore size and ornamentation. Thus *I. stuartii* is now considered to be conspecific with *I. muelleri.* The type of *I. muelleri* is more representative of the species than is that of *I. stuartii. I.stuartii* has also frequently been confused with *I. humilior* (Pfeiffer, 1922). Therefore, it is here proposed that *I. stuartii* be reduced to synonomy under *I. muelleri.*

I. muelleri A. Braun, Monatsber. K. Akad. Wiss. Berlin, 541, 1868; Pfeiffer, Ann. Mo. Bot. Gdn, 9, 126, 1922.

Lectotype: Queensland, wet places near Rockhampton, *P. O'Shanesy,* 1867 (B!), (Syntype in K!)

Syn. *I. stuartii* A. Braun, Monatsber. K. Akad. Wiss. Berlin, 539, 1868.

Holotype: Tasmania. South Esk River, *C. Stuart.* (MEL!)

Figs. 23-28. Scanning electron micrographs of developing Type I megaspores of *I. muelleri.*

Fig. 23. Immature Type I megaspore distal-face, *Marsden 178A,* scale = 100 μm.

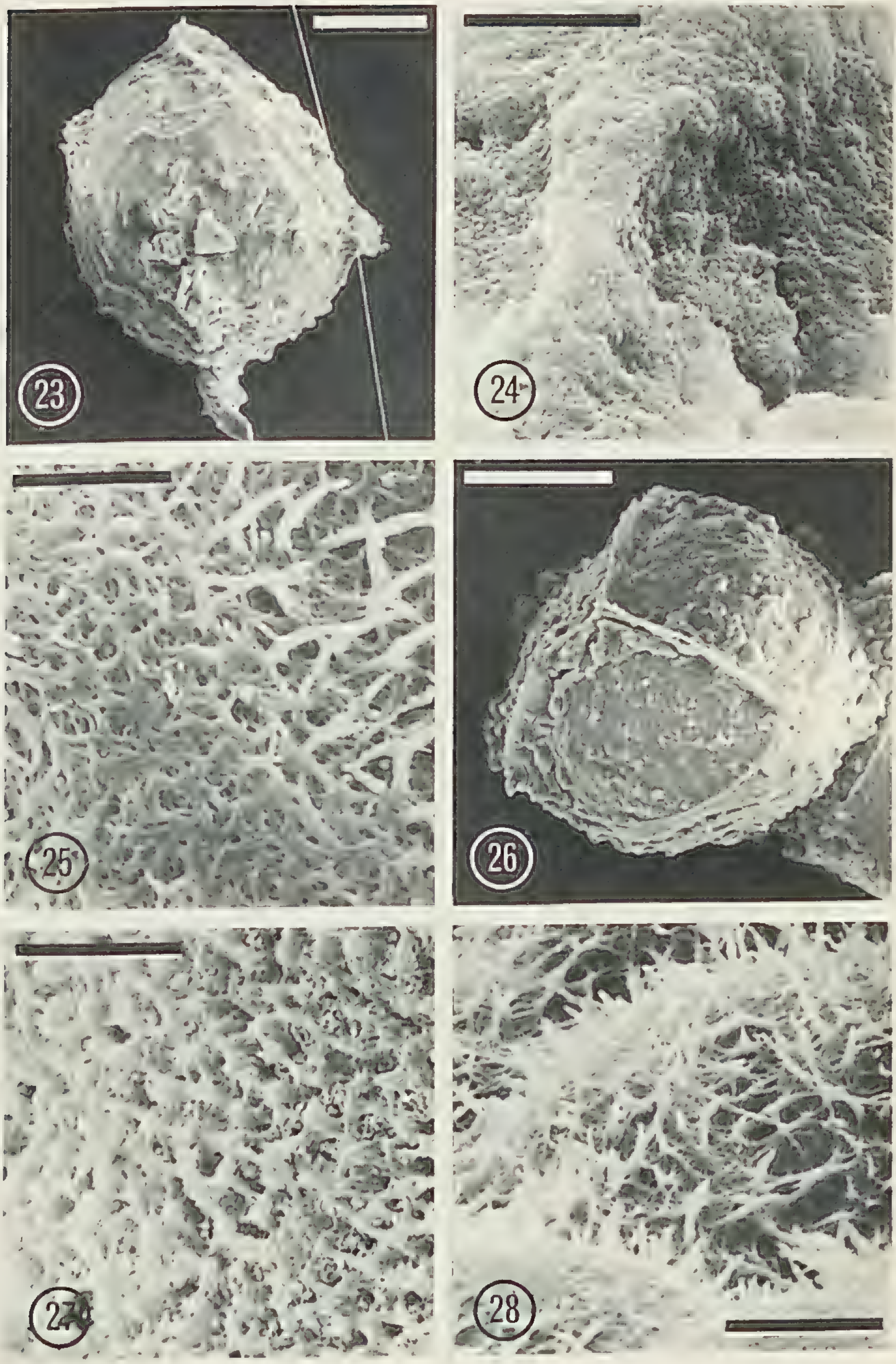
Fig. 24. Detail of surface of spore in fig. 23 showing amorphous siliceous perispore, scale = 10 μm.

Fig. 25. Detail of surface of slightly older megaspore from same plant as figs. 23, 24, showing fully developed surface structure as in fig. 6, scale = 10 μm.

Fig. 26. Immature Type I megaspore, proximal faces, *Beauglehole 47901,* scale = 200μm.

Fig. 27. Detail of surface of spore in fig. 26 showing beginnings of development of spines on surface of perispore, scale = 10 μm.

Fig. 28. Detail of surface of megaspore from next oldest sporangium than that in fig. 26 showing well developed spines on perispore surfaces, scale = 10 μm.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Diagnosis

I. muelleri is distinguishable from other Australian species by the presence of sporangial vela and occurrence of imorphic spores. In Australasian species of *Isoetes*, dimorphic spores are known only from *I. coromandelina* L. f. ssp. *macrotuberculata* C. Marsden (Marsden, 1976) and *I. muelleri* but *I. coromandelina* lacks vela covering the sporangia.

Distribution

I. muelleri is the most widespread species of *Isoetes* in Australia occurring in all states and territories. A map showing the known distribution is given (Map 1).

Representative collections examined

Details are only included for collections referred to in the text.

SOUTH AUSTRALIA: S.E. of S.A. 1 km E. of Comaum Forest, 15.vi. 1973, *Marsden 11* (AD); 19.xii. 1973, *Marsden 32* (AD); S. edge of Comaum Forest, 18.xii. 1973, *Marsden 30* (AD); W. edge Comaum Forest, 19.xii. 1973. *Marsden 35* (AD); S.E. of S.A., Wrattonbullie station, 19.xii. 1973, *Marsden 39* (AD); S.E. of S.A., Marcollat Rocks, 19.x. 1974, *E. M. Wollaston* (AD); Eyre Peninsula, Tassie Ck., 23.viii. 1973, *R. D. Seppelt* (AD); Eyre Peninsula, Carrappee Hill, 12.ix. 1974, *D. E. Symon 9052* (AD).

NORTHERN TERRITORY: Palm Valley, 25.vi. 1974, *A. C. Beauglehole 45893* (MEL); MacDonnell Range, Trephina Gorge, 1.vi. 1974, *A. C. Beauglehole 44864* (MEL).

NEW SOUTH WALES: (incl. A.C.T.): Snowy Mountains, 1.7 km W. Kiandra, 19.i. 1975, *Marsden 177* (AD); Snowy Mountains, Naas Creek, 25.i. 1975 *Marsden 178A, 178B* (AD).

VICTORIA: East Gippsland, Forlorn Hope Plain, 19.i. 1971, *A. C. Beauglehole 36218* (MEL).

TASMANIA: Shannon Lagoon, 30.xi. 1974, *Marsden 133* (AD); 2.xii. 1974, *Marsden 150* (AD); Elizabeth River at Campbelltown, 1973, *D. Morris* (ADU).

WESTERN AUSTRALIA: Mt Madden, 9.viii. 1975, *Marsden 205* (AD); Kimberley's, Galvin's Gorge, 24.vii. 1974, *A. C. Beauglehole 47901* (MEL).

Acknowledgements

I wish to thank Dr E. M. Wollaston for her encouragement and helpful comments on the manuscript. I am also grateful to Dr J. P. Jessop and Mr R. J. Chinnock for their helpful suggestions, and to the Directors of the South Australian State Herbarium (AD); Botanic Garden and Botanic Museum, Berlin (B); Herbarium Australiense (CANB); the Herbarium, Royal Botanic Gardens, Kew (K); the National Herbarium of Victoria (MEL) and the Herbarium of the Northern Territory (NT) for loan of specimens.

I also wish to thank Mr D. Morris, Mr A. C. Beauglehole and Mrs A. C. Alcock for sending numerous specimens.

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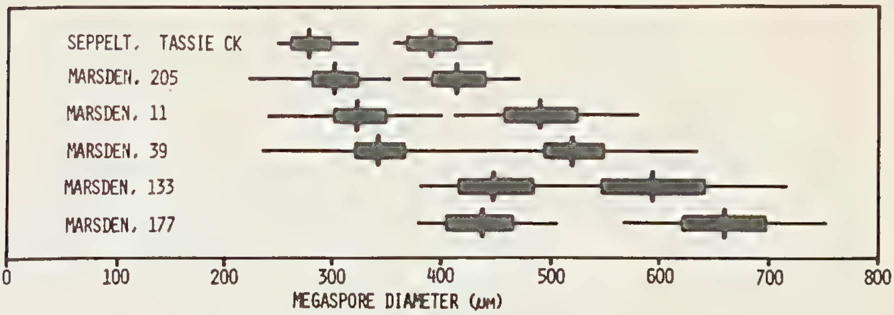
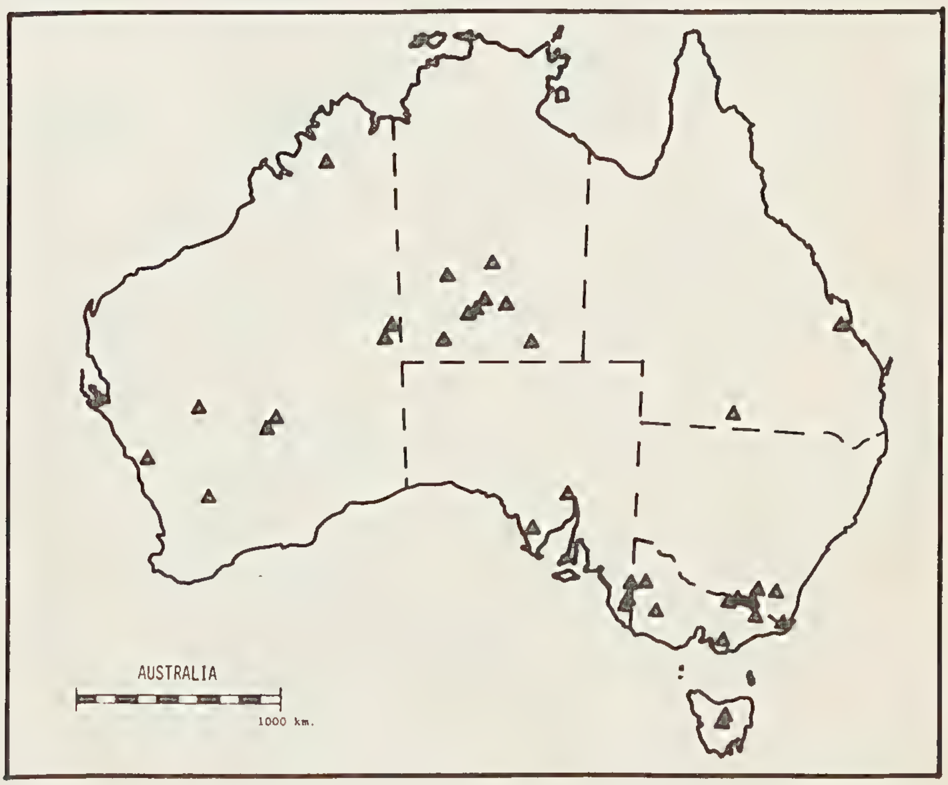


Fig. 29. Plot of megaspore diameters for six populations of *I. muelleri* showing the arithmetic mean, standard deviation (broad bands) and size range (narrow bands).



Map 1. Distribution map of *I. muelleri.*

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J. Adelaide Bot. Gard. 1(1) 55-59 (1976)

A SUMMARY OF THE FAMILY LYTHRACEAE IN THE NORTHERN TERRITORY (WITH ADDITIONAL COMMENTS ON AUSTRALIAN MATERIAL)

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Abstract

This paper presents a synopsis of the nomenclature of the family Lythraceae in the Northern Territory. Keys to the genera and species have been prepared.

The family Lythraceae has been neglected in Australian systematics, and as a result both the taxonomy and nomenclature are confused. Not since the early work of Koehne (1881, 1903) has there been any major revision of the family. Recent work has been restricted to regional floras (Polatschek and Rechinger 1968; Chamberlain 1972; Dar 1975), with Bentham's Flora (1886) being the most recent on the family in Australia.

From a survey of the available literature the author has attempted to extract all the relevant names applicable to Australian material and to present them solely as a survey of the nomenclature of the group. No type material has been seen, and the only material examined was that lodged in the Department of the Northern Territory Herbaria at Alice Springs (NT) and Darwin (DNA). A list of specimens examined has been lodged with the Editor. The present generic placing of any particular species is for convenience only; it does not necessarily represent the best position of that species.

The family comprises 25 genera and about 550 species widely distributed throughout the world, but particularly abundant in the American tropics, and represented in Australia by 8 genera and approximately 24 species.

Key to genera in Australia

1.	Trees or shrubs	2
	Herbs or scarcely undershrubs	4
2.	Bracteoles present	8 *Lagerstroemia*
	Bracteoles absent	3
3.	Petals 4, stamens 8; inflorescence a panicle; fruit indehiscent	5 *Lawsonia*
	Petals 6, stamens 12; flowers solitary; fruit an operculate capsule	6 *Pemphis*
4.	Calyx tube narrow, tubular	4 *Lythrum*
	Calyx tube short, campanulate-ovate to urceolate	5
5.	Calyx with 6 primary and 6 accessory teeth	7 *Peplis*
	Calyx with accessory teeth minute or absent	6
6.	Flowers solitary in the axil; capsule opening by valves	7
	Flowers several in the axil; capsule bursting irregularly	2 *Ammannia*
7.	Flowers ± sessile	1 *Rotala*
	Flowers on slender pedicels	3 *Nesaea*

1. ROTALA L., Mant. 143, 175 (1771).

Fifty tropical and subtropical species; hygrophilous.

This genus has often been included in *Ammannia* (Bentham 1866; Blatter and Hallberg 1918), but I believe it is distinct and can easily be separated by its flowers, which are solitary and sessile in the leaf axils; and its fruit, which is septicidally 3-5 valved. In

contrast, *Ammannia* has flowers pedicellate in cymes, and the fruit dehiscing in an irregularly-circumcissile manner. Leeuwen (1971) has undertaken a preliminary revision of *Rotala* in Malesia.

Koehne (1903) and Burbidge (1963) state that five species occur in Australia of which two are endemic.

Key to species of *Rotala* in the Northern Territory.

1. Petals present .... *R. densiflora*
   Petals absent 2
2. Leaves orbicular; capsule 2-valved .... *R. diandra*
   Leaves narrow or oblong; capsule 3-valved 3
3. Leaves in whorls of three; bracteoles scarious ± equalling calyx .... *R. mexicana*
   Leaves opposite or in whorls of four; bracteoles herbaceous, to three times as long as calyx 4
4. Leaves ovate-oblong, opposite or in whorls of four; bracteoles three times as long as calyx, enclosing capsule .... *R. occultiflora var. occultiflora*
   Leaves linear-lanceolate, decussate; bracteoles narrow, twice as long as calyx, not enclosing capsule .... *R. occultiflora var. leichhardtii*

Rotala densiflora (Roth) Koehne, Bot. Jahrb. Syst. 1 : 164 (1880).

Basionym: *Ammannia densiflora* Roth in Roem. et Schult., Syst. Veg. 3 : 304 (1818).

Synonyms: *Ammannia pentandra* Roxb., Fl. Indica 1 : 448 (1820).
Rotala roxburghiana Wight, Icon. Pl. Indiae Orient. 1 : t.260B (1840).
?*Rotala leptopetala* (Bl.) Koehne, Bot. Jahrb. Syst. 4 : 338 (1883).
?*Rotala longibracteolata* Domin, Biblioth. Bot. 995 (1928).

Africa, Asia, Australia. (2 specimens seen).

In Backer and Bakhuizen van den Brink (1963) *R. densiflora* and *R. leptopetala* are listed as separate species, with the comment (p.253), '. . . hardly different from each other.'

The only difference between *R. longibracteolata* and *R. densiflora* is the apparent lack of petals in the former; where Domin states (p.996), 'differt petalis nullis'.

Rotala diandra (F. Muell.) Koehne, Bot. Jahrb. Syst. 1 : 169 (1880).

Basionym: *Ameletia diandra* F. Muell., Fragm. Phytogr. Aust. 3 : 108 (1862).

Synonym: *Ammannia diandra* (F. Muell.) Benth., Fl. Austral. 3 : 296 (1866).

Endemic to northern Australia. (5 specimens).

Rotala diglossandra Koehne, Bot. Jahrb. Syst. 23 : 17 (1897).

Endemic to Australia (Schomburgk no. 318). (No specimen).

Note that this species has not been included in the key.

Rotala mexicana Cham. et Schltdl., Linnaea 5 : 567 (1830).

Synonyms: ?*Rotala verticillaris* L., Mant. 2 : 175 (1771).
Rotala apetala F. Muell., Fragm. Phytogr. Aust. 3 : 108 (1862).
Ammannia rotala (F. Muell.) F. Muell. ex Benth., Fl. Austral. 3 : 295 (1866).

Tropical Africa, Asia, northern Australia, Central and South America. (4 specimens).

Neither Koehne (1903) nor Blatter and Hallberg (1918) consider this species to be synonymous with *R. verticillaris* L. However, Bentham (1866) lists *R. verticillaris* under the synonymy for *Ammannia rotala* (F. Muell.) F. Muell. ex Benth. Indeed, the only difference I can find between the two descriptions is that *R. verticillaris* has petals whereas *R. mexicana* does not. Bentham further states in his description (p.295), 'Petals none or

minute and fugacious in the Australian specimens . . .'. If it is the case that these two species are synonymous, then they are referrable to the name *R. verticillaris* L.

Koehne (1903) refers the Australian material to var. *spruceana* (Benth.) Koehne, Bot. Jahrb. Syst. 6: 151 (1881). This name is based on *Hypobrichia spruceana* Benth. in Griseb., Cat. Pl. cub. 106 (1866). However, if the Australian material proves to be distinct, it must be referred to the name *Rotala apetala* F. Muell.

Rotala occultiflora Koehne, Bot. Jahrb. Syst. 1:152 (1880.).

Whilst Blatter and Hallberg (1918) do not retain the variety *leichhardtii* Koehne, it does seem to be quite valid from an inspection of our specimens.

var. **occultiflora** India, Australia (4 specimens).

var. **leichhardtii** Koehne, op. cit. 4:387 (1883).

Northern Australia (4 specimens).

2. AMMANNIA L., Sp. Pl. 119 (1753).

Thirty cosmopolitan species.

Whilst Burbidge states that seven species occur in Australia, with two endemic, some of these may be listed in synonomy with *Rotala* species.

Koehne lists only three, although he transfers some to the genus *Nesaea*.

Key to species of *Ammannia* in the Northern Territory.

1. Leaves auricled at the base 2
   Leaves narrowed at the base 3
2. Capsule less than 2 mm diameter .... *A. multiflora*
   Capsule about 3 mm diameter .... *A. auriculata*
3. Calyx appendages large .... *A. triflora*
   Calyx appendages absent .... *A. baccifera*

Ammannia baccifera L., Sp. Pl. 2:175 (1762).

Synonym: *Ammannia indica* Lam., Tab. Encyc. Meth. 1:311 (1791).

Europe, Africa, South East Asia, northern Australia. (5 specimens).

Ammannia triflora R. Br. ex Benth., Fl. Austral. 3:297 (1866).

Northern Australia — Islands of the Gulf of Carpentaria. (2 specimens).

Ammannia auriculata Willd., Hort. Berol. 1:67 (1806).

North and South America, Africa, Asia, Australia. (27 specimens).

Bentham (1866, p. 298) states that *Ammannia multiflora* Roxb. is probably a smaller flowered variety of *A. auriculata*.

Ammannia multiflora Roxb., Fl. Indica 1:447 (1820).

Synonym: *Ammannia australasica* F. Muell., Trans. Philos. Soc. Victoria 1:41 (1855).

Africa, Asia, Australia.

3. NESAEA Commers. ex Humb., Bompl. et Kunth, Nov. Gen. Sp. 6: ed. fol. 151, ed. qu. 191 (1823).

Fifty tropical species.

The status of this genus is still the cause of some contention. Many of the species under this name have been assigned to other genera in the Lythraceae. Burbidge states that four species occur in Australia (3 endemic) while Koehne lists three (1 endemic).

Nesaea crinipes (F. Muell.) Koehne, Bot. Jahrb. Syst. 3:337 (1882).

Basionym: *Ammannia crinipes* F. Muell., Trans. Philos. Soc. Victoria 3:49 (1859).

Endemic to northern Australia. (2 specimens).

Nesaea repens W. V. Fitzgerald, J. Roy. Soc. Western Australia 3:181 (1918).
Fitzroy River, Western Australia. (No specimens).

Nesaea robertsii (F. Muell.) F. Muell. ex Koehne, Bot. Jahrb. Syst. 3:336 (1882).
Basionym: *Lythrum robertsii* F. Muell., Fragm. Phytogr. Aust. 7:145 (1871).
Bowen Downs Station, Queensland. (No specimens).

Mueller distributed this species under the name *Nesaea robertsii.*

4. LYTHRUM L., Sp. Pl. 446 (1753).

Thirty-five cosmopolitan species.

Key to species of *Lythrum* in Australia.

1. Plant hairy .... *L. salicaria*
   Plant glabrous 2
2. Lower leaves opposite, upper alternate 3
   All leaves opposite 4
3. Procumbent annual; stamens 4-6, enclosed .... *L. hyssopifolium*
   Ascending perennial; stamens 12, six exserted .... *L. flexuosum*
4. Flowers solitary on long peduncles; stamens 6 .... ? sp. nov.
   Flowers 2 or more; stamens 12 .... *L. arnhemicum*

Lythrum arnhemicum F. Muell., Fragm. Phytogr. Aust. 3:109 (1862).
Northern Territory. (2 specimens).

Lythrum hyssopifolium L., Sp. Pl. 447 (1753).
All Australia except N.T. (3 specimens).

Lythrum flexuosum Lag., Gen. & Sp. Pl. 16 (1816.).
Introduced S.A., Vic. (No specimens).

Lythrum salicaria L. Sp. P. 446 (1753).
All Australia except W.A. and N.T. (2 specimens).

Lythrum sp. nov.
Northern Territory. (3 specimens).

(Note: two specimens identified as *Lythrum* could not be placed in any described species, viz., *P. K. Latz 182, 464.* I am not yet certain if these are new species).

5. LAWSONIA L., Sp. Pl. 349 (1753).
A monotypic genus of tropical and subtropical Africa, Asia and northern Australia.

Lawsonia inermis L. Sp. P. 349 (1753).
Synonym: *Lawsonia alba* Lam., Encycl. Meth. 3:106 (1789).
Melville Island and Darwin area. 'Henna'.

6. PEMPHIS Forst. et Forst.f., Charact. Gen. Pl. 67 (1776).
A genus of only two species; one on paleotropical coasts from Africa to the Pacific, the other in Madagascar.

Pemphis acidula Forst. et Forst.f., Charact. Gen. Pl. 68, t.34 (1776).
Northern Australia.

7. PEPLIS L. Sp. Pl. 332 (1753).
Three species in temperate areas of the northern hemisphere.

Peplis portula L. Sp. Pl. 332 (1753).

An introduced plant naturalised in Queensland. 'Water Purselane'.

8. LAGERSTROEMIA L., Syst. Veg. ed. 10: 1068, 1076, 1372 (1759).

Fifty-three species in paleotropic areas. In Australia, restricted to Queensland. Furtado and Srisuko (1969) have revised the genus.

From this nomenclatural survey it can be seen that taxonomic problems exist at both the generic and specific levels. It is hoped that this paper will provide a basis for further work on the group.

Acknowledgements

I would like to thank Hj. Eichler for his comments on the nomenclature of *Nesaea robertsii* and J. R. Maconochie for his advice and encouragement in the preparation of this paper.

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J. Adelaide Bot. Gard. 1(1) 61-67 (1976)

PLANT PORTRAITS

From time to time as suitable material becomes available for illustration, hitherto poorly figured, or poorly documented species will be featured to assist identification, or to provide records in cases where taxa may be threatened with extinction. The descriptions will be based on living material which should be a help where herbarium specimens have formed the basis for description of the type. The following orchids have, for example, had only their flowers illustrated in the past.

This series may also provide an opportunity for the skills of Australian and other botanical artists to be brought together for their own intrinsic value, and to allow comparison and a record of different styles of execution.

The editors will be glad to receive line drawings of appropriate quality and text arranged in the following format, particularly from workers specialising in groups for which there is a poor iconography or poor documentation. The formal description and illustration of new species and notable cultivars may also be submitted, as may comparative drawings and descriptions which assist with the identification of critical botanical and horticultural groups of vascular plants.

1. Bulbophyllum formosum Schltr. (Orchidaceae)

Bulbophyllum formosum Schltr., *Repert. Spec. Nov. Regni Veg. Beih.*, Bd. 1, Heft 9, 712 (1912): ic. *Repert Spec. Nov. Regni Veg. Beih.*, Bd. 21, Figuren-Atlas zu den Orchidaceen von Deutsch-Neu-Guinea, Tafel ccxxxi, Nr. 878 (1923-28), flower with dissection only.

Flowered Adelaide Botanic Garden on April 7, 1976, accession number 202-73, collected from Kassam Pass, Morobe Province, Papua New Guinea by collector for the National Herbarium and Botanic Garden, Papua New Guinea, alt. c. 1000 m. Herbarium voucher AD Herb. Pl. Cult. 6522.

Plant c. 18 cm tall, rhizome short with filiform roots, *pseudobulbs* conical, c. 3 cm long and 1 cm diameter at widest part, with two dark brown papery sheaths, single leaved, *leaves* erect but also recurving, c. 13 cm long and 2-2.5 cm wide at widest part, oblanceolate-ligulate, shortly apiculate, cuneate into petiole, petiole c. 1.5 cm long, channelled above, paler green than lamina, lamina with shallowly grooved midrib above and three obscure veins on either side, glabrous, coriaceous, deep green, beneath paler green and minutely mottled grey, only midrib conspicuous: *scape* basal, erect, slender, single flowered, sheaths two, each about 7 cm long, obscurely purple mottled above, bracts linear-lanceolate, green tipped, free part c. 5 mm long: *flowers* erect in bud, buds acute, c. 2 mm diameter and 2.5 cm long, obscurely veined purple, opening erect, showy, *outer tepals* first reflexed later directed forward, lanceolate, long acuminate, *laterals* c. 6.2 cm long and c. 5 mm wide at base with inside three unequal claret stripes on white ground, tips creamy white, glossy, glabrous, outside white with claret suffusion of interior stripes, *dorsal tepal* c. 6.2 cm long and c. 4 mm wide at base with inside three equal claret stripes on white ground, tip creamy white, *inner tepals* erect, *laterals* c. 1 mm long, inconspicuous, transparent with claret mark on one lobule, falcate, acuminately cusped, *lip* c. 6 cm long, with two auricles at junction with column and conspicuously convex above, with two obscure carinae below, lip lanceolate, minutely and densely claret papillose in irregular pattern on white ground, suffused yellow above, tip long acuminate and creamy white, *column* slender, transparent, curved, with four acuminate tips all edged claret, and a ventral suture, *pollinia* not seen, *ovary* slender, pale green below, suffused purple at junction with tepals, c. 3 cm long, thickened above, *fruits* not seen.

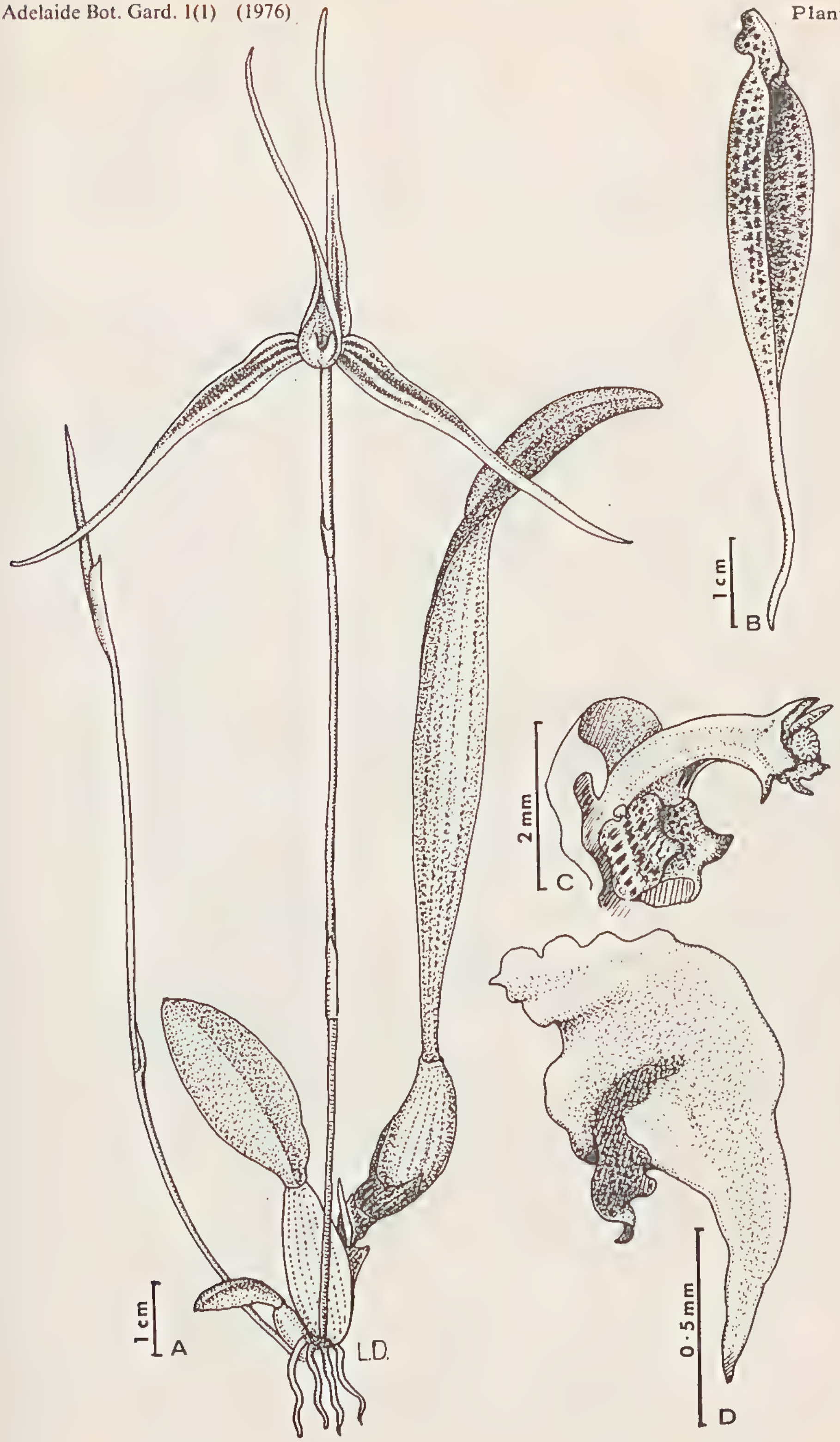
The plant in cultivation agrees well with the type description and with the published illustration of a flower and its parts. Allied species which have been illustrated include *B. pulchrum* Schltr. (Tafel ccxxxi nr. 876), and *B. nitidum* Schltr. (nr. 877), both in the same work, and both with differently shaped inner tepals and floral dimensions. Also related is *B. quadricaudatum* J.J.Sm., illustrated in Smith (1911), but this species has long acuminate inner lateral tepals.

The plant of *B. formosum* is grown in pine bark in a pot in an orchid house, and makes a small but attractive subject with its velvety, claret-mottled lip and claret striped outer lateral tepals.

Smith, J. J. (1911). Resultats de l'expedition scientifique Neerlandaise a la Nouvelle-Guinee en 1907 & 1909. *Nova Guinea* 8(1): t. 104.

B. Morley

a. flowering plant, b. lip, c. column, d. inner lateral tepal.


1cm
A
L.D.
1cm
B
2mm
C
0·5mm
D

2. Diplocaulobium dichrotropis (Schltr.) A. D. Hawkes (Orchidaceae)

Diplocaulobium dichrotropis (Schltr.) A. D. Hawkes, *Lloydia,* 20:128 (1957).

Basionym: *Dendrobium dichroptropis* Schltr. *Repert. Spec. Nov. Regni Veg. Beih.*, Bd. 1, Heft 6, 462 (1912): ic. *Repert. Spec. Nov. Regni Veg. Beih.*, Bd. 21, Figuren-Atlas zu den Orchidaceen von Deutsch-Neu-Guinea. Tafel clv, Nr. 582, (1923-28), flower with dissection only.

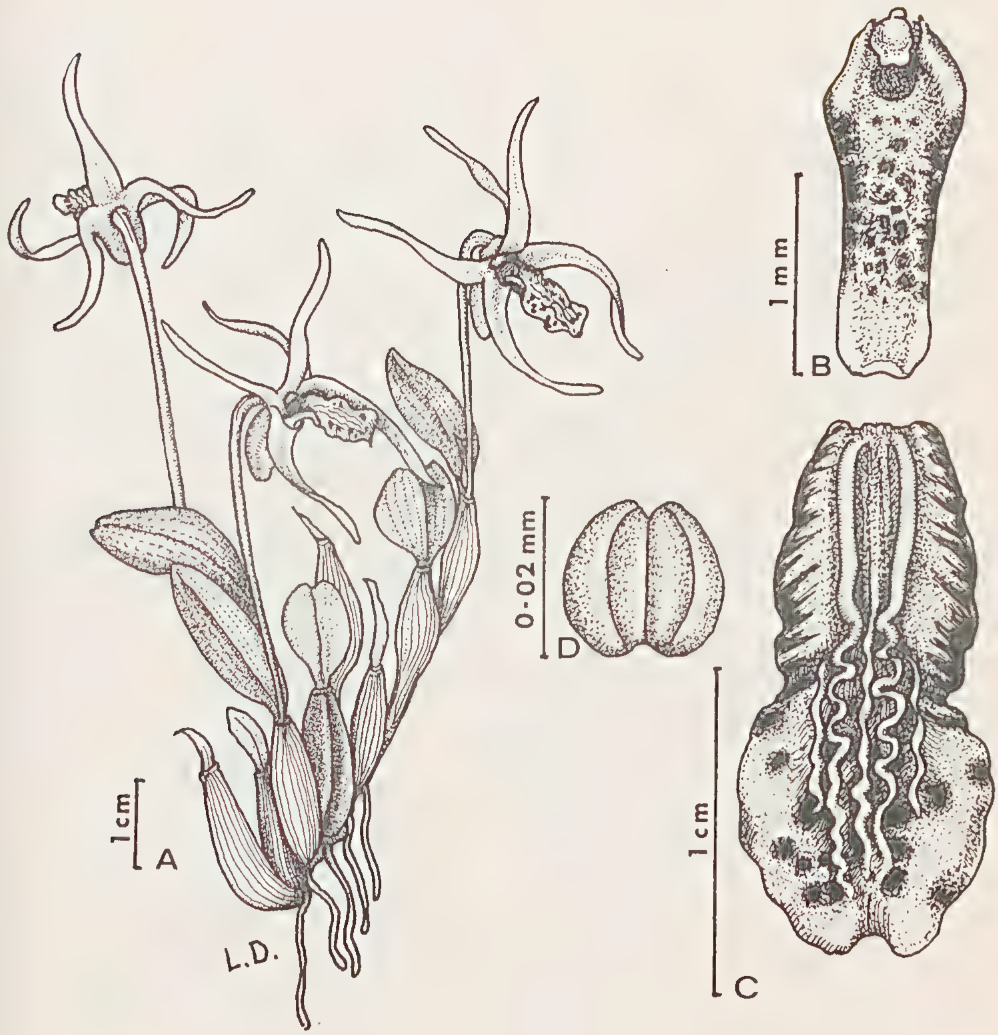
Flowered Adelaide Botanic Garden on April 15, 1976, accession number 317-69, collected from Daulo Pass, c. 2800 m, Papua New Guinea by collector of the Department of Forests, Lae. Herbarium voucher AD Herb. Pl. Cult. 6562.

Plant c. 9 cm tall, rhizome spreading and ascending with filiform roots, rhizome c. 1 mm diameter, *pseudobulbs* quadrangular, somewhat winged, c. 1.7 cm long and 5 mm wide at widest part, invested in transparent papery sheath with conspicuous grey nerves, single leaved, *leaves* erect, obliquely twisted, c. 2.6 cm long and 1 cm wide at widest part, ovate, tip notched, notch c. 0.75 mm deep, leaf base cuneate, sessile, lamina with grooved midrib above and two obscure pale grey lateral veins on either side, glabrous, coriaceous, deep green, below paler green, minutely mottled with stomates, midrib noticeable beneath with three less conspicuous darker green lateral veins on either side: *scape* erect, terminal, c. 1 mm diameter, single flowered, pale green with obscure purple mottling above, sheaths two, c. 9 mm long each, transparent and papery with netted veins, egg yellow towards base, lanceolate: *flowers* erect, showy, *outer tepals* pointing forward, falcate, lanceolate and acuminate, *laterals* c. 2 cm long and c. 5 mm wide at base, creamy white with once twisted primrose-yellow tips, glabrous, *mentum* c. 7 mm long and 4 mm wide, creamy white flushed with purple, *dorsal tepal* erect, sigmoid in posture, c. 2 cm long and 3.5 mm wide at base, colour as laterals, *inner tepals* reflexed, *laterals* c. 1.8 cm long and c. 1.5 mm wide at base, colour as outer tepals, linear, acuminate, *lip* c. 1.4 cm long, ligulate, with two straight and prominent basal cream carinae c. 5 mm long, then continuing for 7 mm as two sinuous yellow lamellae with three more sinuous yellow lamellae also appearing towards the tip, lamellae not confluent with margin, lip apex acute, reflexed, ground colour of lip cream, spotted purple at apex, edged purple within mentum, *column* robust, clavate, curving with 3 obtuse tips, cream with purple blotches at base, greenish yellow at tip, *pollinia* four, yellow, *ovary* slender and bent at 90 degrees at junction with tepals, minutely ridged where bent and ridges purple, scape c. 4 cm long including ovary, *fruits* not seen.

The plant in cultivation is allied to *D. dichrotropis* but Schlechter gives larger dimensions for vegetative parts and smaller dimensions for outer tepals; the lip is about the same length in the cultivated plant as in the type description and also has the five apical lamellae on the lip. Such differences may be due to cultivation. These lamellae distinguish the taxon from the related *Diplocaulobium tropidophorum* (Schltr.) A. D. Hawkes (Tafel clv, nr. 580), and *D. jadunae* (Schltr.) A. D. Hawkes (nr. 583), in the same work, both of which have three lamellae on the apical part of the lip. *Diplocaulobium minjemense* (Schltr.) A. D. Hawkes (Tafel clvi, nr. 584) differs from *D. dichrotropis* in having two lateral lobes on either side midway down the lip, but both taxa have five lamellae on the lip. The Australian *D. masonii* (Rupp) Dockr. is also allied to *D. dichrotropis* but has three instead of five lamellae on the apical part of the lip.

The plant at Adelaide makes a small but attractive subject with a spreading habit, flowering synchronously and grown in a pot in pine bark over a water-tank in an orchid house.

B. Morley



a. flowering plant, b. column, c. lip, d. pollinia.

3. Ceratostylis acutifolia Schltr. (Orchidaceae)

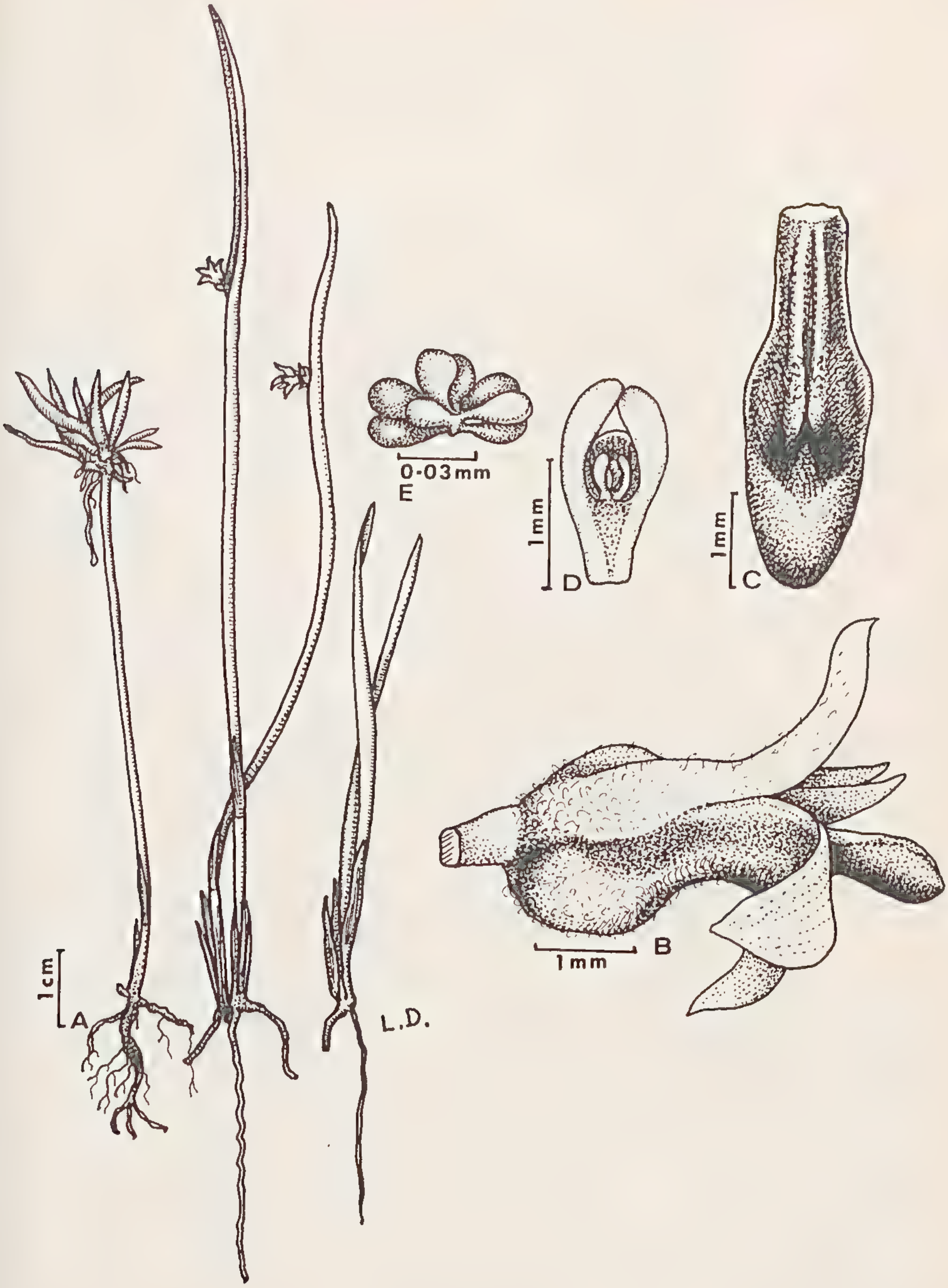
Ceratostylis acutifolia Schltr. *Repert. Spec. Nov. Regni Veg. Beih.*, Bd. 1, Heft 4, 254 (1912): ic. *Repert. Spec. Nov. Regni Veg. Beih.*, Bd. 21, Figuren-Atlas zu den Orchidaceen von Deutsch-Neu-Guinea, Tafel lxxxxiii, nr. 344 (1923-28), flower with dissection only.

Flowered Adelaide Botanic Garden on April 29, 1976, accession number 202-73, collected from Kassam Pass, Morobe Province, Papua New Guinea by collector for the National Herbarium and Botanic Garden, Papua New Guinea, alt. c. 1000 m. Herbarium voucher AD Herb. Pl. Cult. 6470.

Plant c. 16 cm tall, caespitose, rhizome short and ascending, roots filiform, *pseudobulbs* slender, culm-like and terete, c. 11 cm long and 2 mm diameter at widest part, with several dark brown papery sheaths c. 1 cm long, single leaved, *leaves* erect, to 4 cm long and 3 mm wide at widest part, linear-lanceolate, acute, with 0.5 mm wide basal annulus, channelled above, veins not evident, rounded beneath, glabrous, coriaceous, greyish-green: *flowers* in sessile several-flowered heads, opening successively, terminal on pseudobulb, bracts ovate, apiculate, one green bract at base but brown nearer tip, c. 3 mm long, other bracts chaffy and c. 1 mm long, flower buds c. 2 mm long and 1 mm wide, dull pink, opening erect, inconspicuous, c. 4 mm long, *outer lateral tepals* reflexed, *dorsal* directed forward, all ovate-lanceolate, c. 3.5 mm long and 1 mm wide, dull pink, *inner tepals* erect, *laterals* c. 3 mm long and 0.5 mm wide, small, transparent, *lip* narrowed at base, ligulate in profile, especially fleshy at tip, dull pink, paler at tip, c. 4 mm long, *mentum* glabrous or with minute adpressed hairs like tepals, c. 1.5 mm long, *column* 1.5 mm long, white, with two oblong processes at apex, glabrous, anther white, reniform, *pollinia* eight, yellow, shortly clavate, *ovary* cylindrical, c. 1 mm long, green, sheathed by two pink bracts c. 2 mm long with apiculate tips, *fruit* not seen.

The type description of this taxon states that the flowers "sind rotbraun mit vorn gelbem Labellum", and also gives floral dimensions which are larger by about 50% than those of the cultivated plants. However, the shape of floral parts, mentum and other characters seem to relate to *C. acutifolia.* Not mentioned by Schlechter is the tendency for the old inflorescence clusters to proliferate new plantlets with roots, affording a means of vegetative propagation for this plant with a remarkably cyperaceous appearance when not in flower. The proliferation may be stimulated by the humidity of our orchid house. It has more botanical interest than beauty.

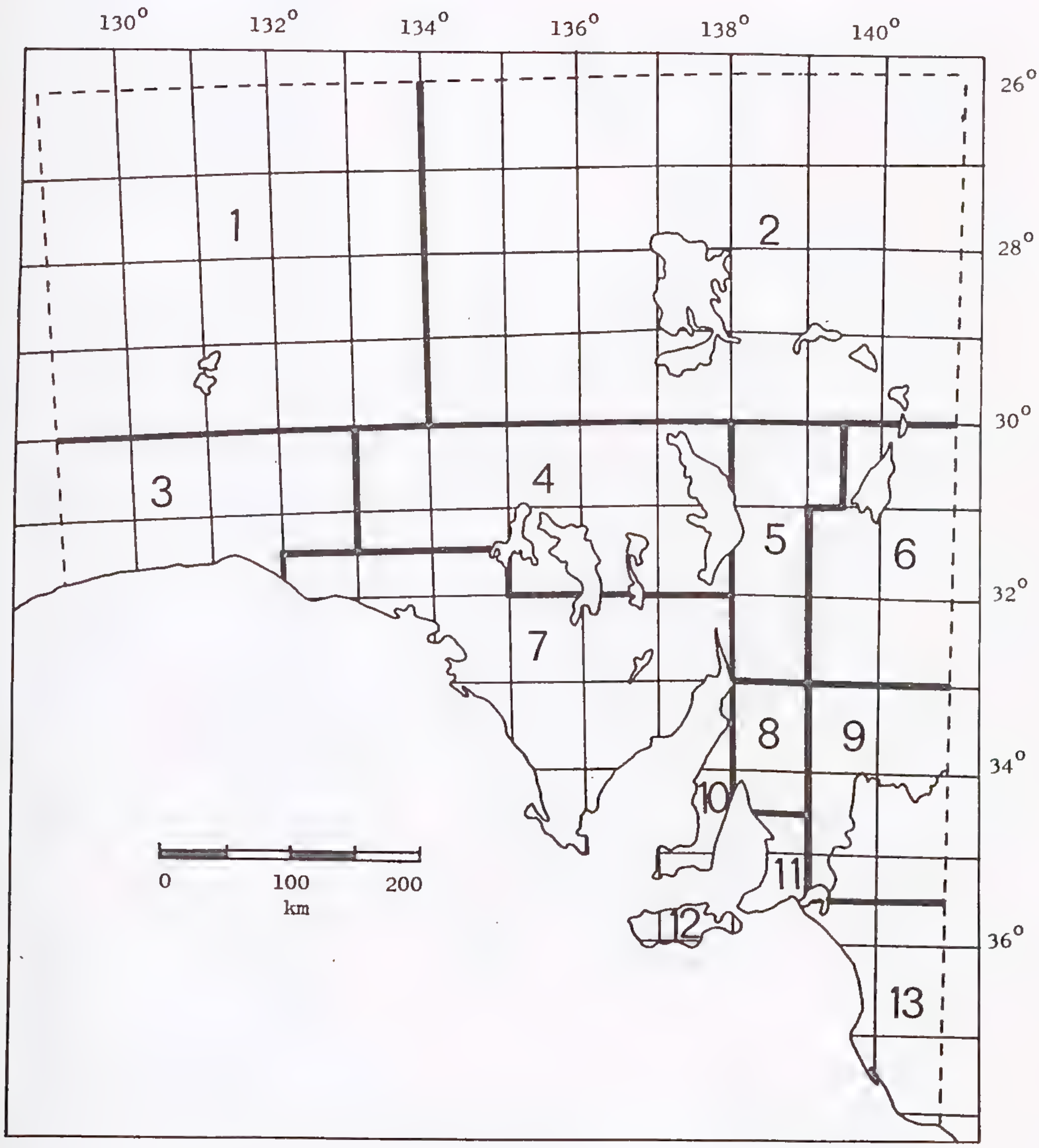
B. Morley



a. flowering and proliferating plants, b. flower, c. lip, d. column from beneath showing pollinia *in situ*, e. pollinia.

REGIONS OF SOUTH AUSTRALIA ADOPTED BY THE STATE HERBARIUM — ADELAIDE

1. North-western
2. Lake Eyre Basin
3. Nullarbor
4. Gairdner-Torrens Basin
5. Flinders Ranges
6. Eastern
7. Eyre Peninsula
8. Northern Lofty
9. Murray
10. Yorke Peninsula
11. Southern Lofty
12. Kangaroo Island
13. South-eastern



JOURNAL of the ADELAIDE BOTANIC GARDENS

CONTENTS

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JOURNAL of the ADELAIDE BOTANIC GARDENS

Volume 1 Part 2 19 December 1977

Instructions to Authors

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Papers will be accepted in the following categories:

(a) Plant systematics (Australian and horticultural groups)
(b) Descriptive plant morphology, anatomy and ecology
(c) Obituaries, biography and history
(d) Bibliographic studies, book reviews
(e) Botanical illustrations
(f) Noteworthy horticultural contributions.

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Text references to publications should be indicated as follows: (Smith, 1959), (Smith, 1959, p. 127), Smith (1959) or Smith (1959, pp. 125-208). The final section of the paper, headed 'References', should include only those titles referred to in this way. It should be laid out as follows:

Smith, K. L. (1879). The species of *Danthonia* found in pastures in Victoria. *Austral. J. Bot.* 65: 28-53.

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Baker, J. G. (1898). Liliaceae. In Thiselton-Dyer, W. T. (ed.), "Flora of Tropical Africa", Vol. 7 (Ashford: L. Reeve).

Journal abbreviations must be consistent within a paper and authors are recommended to follow "Botanico-Periodicum-Huntianum". Journals not cited in B-P-H should be abbreviated to conform with this general pattern. The following abbreviations for Australian states should be used: WA, NT, SA, Qld, NSW, ACT, Vic., Tas.

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Authors are requested to include in the synonymy only references to publications containing information additional to that to be published in the paper being submitted. Within this section journal and book titles must be consistently abbreviated. B-P-H journal abbreviations and book titles abbreviated in a similar way are desirable. Authors of references cited in the synonymy should be abbreviated.

References may be cited as:

Benth., *Fl. Austral.* 4: 111 (1868) OR
Benth., *Fl. Austral.* 4 (1868) 111.

Citation of specimens

10-30 specimens should be cited for each species (or subspecific taxon), although this may be varied under certain circumstances. The author may decide whether or not to include dates of collections and the sequence, provided a constant pattern is adhered to throughout a paper.

Authors wishing to cite all specimens seen may list them all in an index to collectors after the style of the "Flora Malesiana" identification lists. Collections not identifiable by a collection number (assigned by either the collector or herbarium) should cite dates.

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TAXONOMIC STUDIES IN *STACKHOUSIA* SM. (STACKHOUSIACEAE) IN SOUTH AUSTRALIA

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Abstract

A key to the South Australian species of *Stackhousia* is presented. *S. monogyna* Labill., *S. aspericocca* Schuch. (typified and reinstated as a distinct species although possibly better treated in a future revision as a race of *S. monogyna), S. annua* (a new species). *S. spathulata* Sieb. ex Spreng., and *S. megaloptera* FvM. (a probable new record for South Australia) and several other probably undescribed taxa of Sect. *Stackhousia* Subsect. *Cincinniferae* Mattf. are recognized as occurring in South Australia. Subsect. *Cincinniferae* and the polymorphic *S. aspericocca* require taxonomic study in the context of a revision of the whole genus.

The family Stackhousiaceae is predominantly Australian, with single species in New Zealand and Malesia. The family has been divided by various taxonomists into two or three genera, with *Stackhousia* Sm. the largest and distributed throughout the range of the family. *Macgregoria* FvM., monotypic and occurring in central Australia, differs markedly from the rest of the family. The monotypic genus *Tripterococcus* Endl., confined to Western Australia, has flowers similar to *Stackhousia* and the two genera are often combined; they differ, however, in gynoecial and fruit characters.

Pampanini (Pampanini & Barglagi-Petrucci, 1905-6) provided the most recent revision of the family seventy years ago. His monograph was based solely on material housed in the herbaria of continental Europe. Today it is clear that the taxonomy of the family, in particular *Stackhousia,* is in need of revision. This is most evident in the two major widespread complexes of *Stackhousia,* to the bulk of which the names *S. monogyna* Labill. (Bentham, 1863; Eichler, 1965), and *S. viminea* Sm. and *S. intermedia* F. M. Bail. (Willis, 1973), respectively, have been commonly applied. These two complexes, in which many species have been described, together constitute Sect. *Stackhousia* (= Sect. *Reticulatae* Mattf.), characterized by wingless but sculptured cocci. In Mattfeld's (1942) review of the supraspecific classification of the family they were placed in separate subsections, namely Subsect. *Cincinniferae* Mattf. with flowers arranged in clusters along the inflorescence axis and containing the *S. viminea* s.l. group, and Subsect. *Racemosae* Mattf. characterized by flowers arranged singly in the inflorescence and containing the *S. monogyna* s.l. complex.

This paper gives an insight into the morphological variation and ecological and geographical distribution of the taxa of *Stackhousia* in South Australia, and is preliminary to an intended monograph of the family. The investigation is based on the collections of the State Herbarium of South Australia (AD), and a brief study of the holdings of the National Herbarium of Victoria (MEL).

Key to the Species of *Stackhousia* in South Australia

1a. Flowers arranged in compact clusters along the inflorescence axis. (Fig. 6) .... 5. Sect. *Stackhousia* Subsect. *Cincinniferae*

1b. Flowers arranged singly along the inflorescence axis.

2a. Cocci winged. Leaves spathulate, fleshy. (Fig. 5) .... 4. *S. spathulata*

2b. Cocci lacking wings, sculptured. Leaves lanceolate, often narrowly so, thin to thick.

3a. Annual Cotyledons usually persistent until after flowering. Corolla tube short 4.0-5.2 mm long adaxially, 3.5-4.5 mm long abaxially. Peduncle 1-3(-4) cm long. Gynoecium 3-5-partite. Cocci probably to ca. 1.5 mm long. (Figs. 3 & 4) .... 3. *S. annua*

3b. Perennial. Cotyledons caducous before flowering. Corolla tube long, 5.5-8.1 mm long adaxially, 4.8-7.5 mm long abaxially. Peduncle 8-25 cm long. Gynoecium 3(-5)-partite. Cocci (1.9-)2.1-2.4(-2.8 mm long *(S. monogyna* sensu Black, 1926, 1952).

4a. Bracteoles membranous and/or greatly reduced. Inflorescence cylindrical. Branches usually simple, rarely branched above ground level. (Fig. 1)......... 1. *S. monogyna*

4b. Bracteoles herbaceous, prominent. Inflorescence cylindrical or one-sided. Branches simple or branched above ground level. (Fig. 2)..........................2. *S. aspericocca*

1. **Stackhousia monogyna** Labill., Nov.Holl.Pl.Spec.1(1804) 77, t.104, p.p. (as to element of mixed type to which the name has been universally applied since the protologue; lectotype to be selected from this element as indicated in Int.Code Bot. Nom.Rec.7B and, by inference, by Bentham, Fl. Austral.1(1863)407); Pampanini, Bull.Herb.Boiss.Ser.II,5(1905)916; Black, Fl.S.Austral.(1926)359, p.p.; Black, Fl.S.Austral.(ed.2) (1952)537, p.p.

S. linariifolia Cunn.: Tate, Hdbk.Fl.Extratrop.S.Austral. (1890)29,211, p.p. (specimen leg. *Richards* in Herb. Tate in AD) "linarifolia".

S. obtusa Lindl.: Schuch., Linnaea 26(1853)6 (at least as to *Mueller MEL503702).*

S. flava auct. non Hook. f.: Tate, Hdbk. Fl. Extratrop. S. Austral. (1890)29, 211, p.p. (specimen leg. *Menzel* in Herb. Tate in AD).

In South Australia *S. monogyna* is confined to mallee and woodland areas west of the River Murray, chiefly in red and grey loams and sandy loams. It extends as far north as Moolooloo, near Blinman in the Northern Flinders Range, and as far west as Fowlers Bay. It is noteworthy that in the Mount Lofty Ranges, throughout which *S, aspericocca* abounds, the species only occurs in the foothills and margins of the ranges.

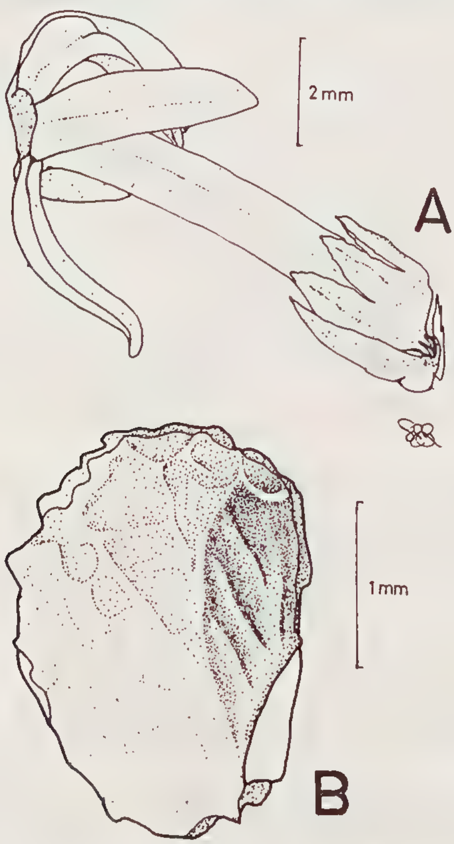

Fig. 1. *S. monogyna.* A, flower, with bract and reduced bracteole *(Barker 648);* B. coccus *(Copley 2299).*

The habitats occupied by the species in South Australia are very different from those of the many populations of the species which I have seen in New South Wales, Victoria and Tasmania, where it flourishes in sclerophyll forest and subalpine woodland. These two races, each of which is very homogeneous morphologically, diverge only in the apparently more fleshy leaves of the South Australian plants and the broader leaves and more frequent occurrence of branching well above ground level of the plants occurring in the other states.

The distinction between *S. aspericocca* and *S. monogyna* based on the nature of the bracteoles is very constant in South Australia. In a number of instances I have observed on Yorke Peninsula populations of the two species within a few metres of each other and flowering simultaneously. Invariably the plants of *S. aspericocca,* in these cases belonging to the race with one-sided inflorescences *(Race 2),* occupy well-drained limestone outcrops, while *S. monogyna,* differing by its cylindrical inflorescences and reduced and/or membranous bracteoles, occurs in the shallow sandy loam between the outcrops. No intergradation has been observed. However, in view of the paucity of diagnostic characters, a future revision of *Stackhousia* may show that *S. monogyna* should best be considered a race of a polymorphic species encompassing *S. monogyna* and *S. aspericocca,* and possibly *S. huegelii* Endl. and *S. pubescens* A. Rich. of Western Australia.

Representative and cited specimens

SOUTH AUSTRALIA (ca. 165 specimens seen): *Alcock 2421,* 12.x.1968, Eyre Peninsula, Hincks National Park, Blue Range area, AD. — *Barker 648,* 14.x.1968, Yorke Peninsula, scrub, off the Curramulka-Port Vincent road, Hundred of Ramsay, Section 141, AD. — *Barker 1826,* 25.viii.1974, Southern Lofty, western half of Sandy Creek Conservation Park, which is ca. 1 km south of main Sandy Creek-Lyndoch road, AD. — *Carrick 3571,* 30.vii.1974, Murray, Monarto New Town area, ca. 15 km west of Murray Bridge, Narringen hills, AD. — *Copley 2299,* 30.ix.1968, Northern Lofty, railreserve, ca. 50 m east of first road crossing ca. 2 miles east of Barunga Gap, AD. — *Hunt 1356,* 4.xi.1962, South-eastern, near Bordertown, AD. — *G. Jackson 37,* 17.ix.1960, Kangaroo Island, Kingscote, AD. — *Menzel s.n.,* ix.1898, Northern Lofty, Port Wakefield, AD96916023 (Herb. Tate). — *Mueller s.n.,* s.dat., Southern Lofty, Mons Kaiserstuhl, MEL503702. — *Richards s.n.,* i.1880, Eyre Peninsula, Fowler's Bay, AD96916032. — *Symon 7355,* 14.ix.1971, Flinders Range, Oraparinna National Park, on the E face of the Heysen Range below Mt Hayward and above Aroona Valley, AD.

VICTORIA (24 specimens seen): *Ackland 90,* 2.x.1963, Nhill-Jeparit road, 0.4 miles S.W. of Glenlee junction, AD. — *Barker 1487,* 24.xii.1971, on the Moroka Road, which is between Mt Arbuckle and the Moroka River, at the beginning of the track to Mt Wellington and Lake Tali Karng, AD. — *Barker 1619,* 12.i.1972, Cobberas Mountains, on the extreme summit area of Mt Cobberas No. 1, AD.

NEW SOUTH WALES (7 specimens seen): *Barker 1639,* 18.i.1972, Brindabella Range, ca. 20 m below and to the E of the summit of Mt Ginera, AD.

TASMANIA (29 specimens seen): *Barker 891,* 4.xi.1970, the south-eastern side of George Bay, ca. 10 km east of St Helens, on track to St Helens Point, AD. — *Barker 959,* 13.xi.1970, Eaglehawk Neck; on the north shores of Pirates Bay, ca. ¼ km east of "Tesselated Pavement", AD. — *Barker 989,* 24.xi.1970, ca. 1 km from Arthur River holiday resort on the Marrawah road, AD.

2. **Stackhousia aspericocca** Schuch., Linnaea 26(1854)12; Pampanini, Bull. Herb. Boiss. Ser. II,5(1905)1048; Eichler, Suppl. Black's Fl.S.Austral. (1965)213. LECTOTYPUS HIC PROPOSITUS: *Anon. s.n.,* s.dat. Mount Gambir, MEL503706 (for typification see p. 73-74).

S. muelleri Schuch., Linnaea 26(1854)16 (at least as to MEL syntypes seen). TYPIFICATION: see p. 73/74.

S. linariifolia auct.non Cunn.: Tate, Hdbk.Fl.Extratrop.S.Austral. (1890)29,211,pp.(as to *Tepper AD96916035 and Anon. AD96916033* in Herb. Tate in AD) "S. linarifolia".

S. flava auct.non Hook.f.: Tate, Hdbk.Fl. Extratrop.S.Austral. (1890)29, 211, p.p. (as to *Anon.AD96916024* from Victoria in Herb. Tate in AD; other specimens, unnamed, of same taxon from S. Austral. in Herb. Tate).

S. monogyna auct.non Labill.: Black, Fl.S.Austral.(1926)359, p.p.; Black, Fl.S.Austral.(ed.2) (1952)537, p.p.

S. spathulata auct.non Sieb.ex Spreng.: Black, Fl.S.Austral. (1926)359, p.p. (as to *Cleland AD966090192* at least p.p., & *Cleland AD96905033* p.p., *AD966090249);* Black, Fl.S.Austral. (ed.2) (1952)537, p.p. (as to same specimens).

Although this species was recognized to be distinct from *S. monogyna* in both the last monograph of Stackhousiaceae (Pampanini & Barglagi-Petrucci, 1905-6) and the review of the family in Engler & Prantl, 'Die natürlichen Pflanzenfamilien' (Mattfeld, 1942), like many works of similar nature these have been overlooked or ignored in the floras of the past 50 years in preference for the concepts proposed in Bentham's 'Flora Australiensis' (1863) and Mueller's 'Fragmenta Phytographiae Australiae' (1862), in which the two species were united.

S. aspericocca, as defined here, is very polymorphic in South Australia. There are a number of ecotypes separable on the basis of habit, inflorescence and fruit surface characters. The rank to be attributed to these taxa can only be decided in a revision of the whole genus. In the sclerophyll forest of the Mount Lofty Ranges, on Kangaroo Island,

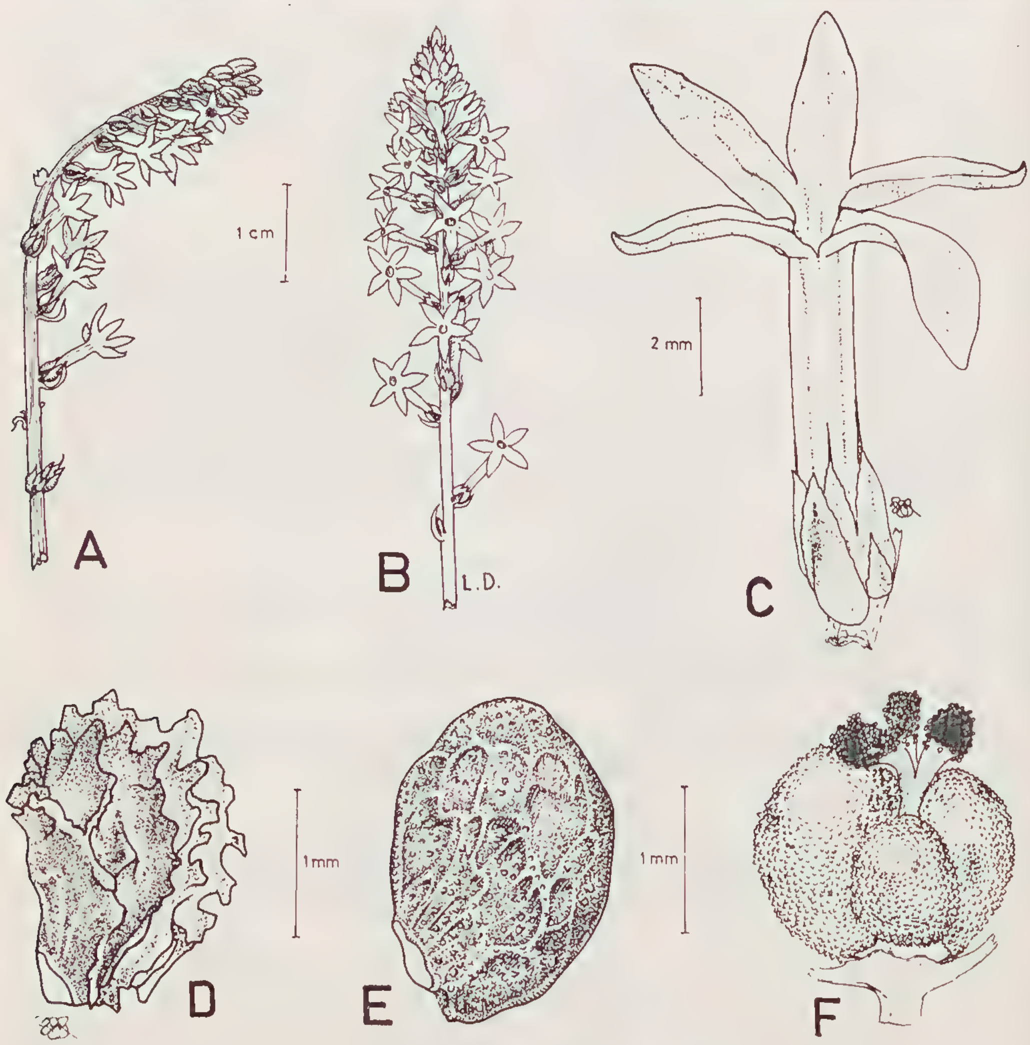

Fig. 2. *S. aspericocca.* A, unilateral inflorescence (Race 2: *Barker 658);* B, cylindrical inflorescence (Race 1: *Barker 555);* C, flower, with bract and prominent bracteole (Race 1: *Barker 671);* D, coccus (Race 2: *Alcock A D96524036);* E, coccus (Race 1: *Barker 682);* F, gynoecium after anthesis, showing asperate surface (Race 1: *Barker 676).*

and in the South-East of South Australia extending into western Victoria are populations distinguished by plants branched well above ground level and cylindrical inflorescences (fig. 2B) with usually white or pale yellow flowers (*Race 1*); this race has been rarely found on Yorke and Eyre Peninsulas. On poorer drier soils in such forest areas (often on very steep slopes) or in mallee communities throughout South Australia including the Mt Lofty Ranges and western Victoria, occurs a second variant (*Race 2*) characterized by branching confined to ground level and unilateral inflorescences, i.e. with flowers directed to one side (fig. 2A). Flower colour is pale to deep yellow. Syntype material of *S. aspericocca* in Herb. Sonder (MEL) belongs to this race. From annotations on specimens in MEL this variant constitutes part of the "frequent form" of *S. monogyna* of Willis (1973) in Victoria, "in Mallee sand-hill country, also heaths and around the Grampians"; the other component is *S. monogyna* s. str. The unilateral inflorescences usually arise by curvature of the pedicels, but rarely are produced by early bud drop on one side of the rachis (*Barker 698, 699*). The cocci of this variant tend to be deeply tuberculate in populations in mallee areas (fig. 2D), and shallowly rugose-reticulate in more forested regions. A third variant (*Race 3*) with branching from ground level only, broad thick leaves, a cylindrical inflorescence with white to pale yellow flowers, and shallowly rugose-reticulate cocci is confined to coastal heath on the cliff-tops of the southern ends of Yorke and possibly Eyre Peninsulas. Poor flowering collections (*Cleland AD966090192, AD966090249, AD96905033* p.p.) from Rocky River and Cape du Couedic, Kangaroo Island, which approach *S. spathulata* in habit and leaves, belong with this race of *S. aspericocca.*

On central Yorke Peninsula and in the Mount Lofty Ranges, the Upper and Lower South-East and south-western Victoria, I have observed numerous populations, sometimes with two races growing sympatrically but in different habitats with no evidence of intergradation. Field studies are required, however, to test whether *Races 2* and *3* intergrade or are maintained as distinct populations on Eyre Peninsula. Herbarium material attributable to either of these races from localities throughout Eyre Peninsula is difficult to place as the inflorescence character is often obscured in pressing. Hence future collections should bear reference to the nature of the inflorescence.

Typification of S. aspericocca *and* S. muelleri

In the protologue of *S. aspericocca* Schuchardt (1854) cited several collections thus:-

"In Nova Holland.austr.detexit Ferd. Muller, Specimen. vidi in Herb.Sonder. — Mons Gambir — Barrossa-range. — In insula Van Diemen legit Dr Stuart."

I had the opportunity of searching the material of Stackhousiaceae in the Sonder Herbarium in MEL, and located several specimens clearly studied by Schuchardt in view of determinations such as "Stackhousia aspericocca, mihi" and others in an identical hand in the form "Stackhousia aspericocca Schuchardt".

In the case of *S. aspericocca* specimens located were:-

(1) a syntype from "Mount Gambir" *(MEL503706)* annotated "Stackhousia aspericocca mihi" in presumably Schuchardt's handwriting;

(2) probable syntypes which come from the Barossa region, north of Adelaide, which Schuchardt probably summarized as "Barrossa-range" (there being no specimen with this locality in the Sonder Herbarium). One from Tanunda, collected by Behr *(MEL503707)* bears the identification "Stackhousia aspericocca mihi" in Schuchardt's putative hand. The other *(Anon. MEL503695)* with a similar identification has the annotation "Pf inter P. et L.". This abbreviated annotation almost certainly corresponds to the locality provided on a collection in Herb. Sonder *(Dr Behr MEL503696)* which bears in another hand the annotations "Stackhousia aspericocca Schuch." and the locality "inter Pfeiffers Section et Lyndocvalley". These three collections are probably syntypes, although the latter may be an isosyntype.

The only syntype which I have not seen is the one collected by Stuart allegedly from Tasmania ("Van Diemen's Land," abbreviated as "V.D.L."). I have seen no material attributable to *S. aspericocca* (i.e. with prominent herbaceous bracteoles) from Tasmania. Labels on Stuart collections from South Australia were sometimes annotated by Mueller not only with Stuart's locality but also with "V.D.L. explor. F.M.," meaning Tasmanian occurrence confirmed by F. Mueller; an example is the syntype of *S. muelleri* Schuch. from the Mt. Lofty Ranges, South Australia *(Stuart MEL503704:* see later), which Schuchardt considered came from Tasmania. Mueller further contracted the above additional annotation to the confusing "V.D.L. F.M." in material of *Euphrasia collina* R. Br. collected by Stuart near the River Torrens (Barker, 1974). It is therefore possible that the Tasmanian occurrence attributed by Schuchardt (l.c.) to *S. aspericocca* may have arisen from misinterpretation of such annotations accompanying a Stuart collection from South Australia.

All the syntype, or probable syntype material of *S. aspericocca* seen belongs to the variant with unilateral inflorescences and branching confined to ground level *(Race 2).* Since the type description is also descriptive of this variant I choose as *lectotypus* of *S. aspericocca* Schuch. the Mount Gambier collection *(Anon. MEL503706)* which is in excellent condition and exhibits well the diagnostic characters of the taxon.

Syntype material of *S. muelleri* Schuch. published simultaneously with *S. aspericocca* was also seen in Herb. Sonder in MEL. The specimens seen by Schuchardt were cited in the protologue (Schuchardt, l.c.) as —

"In Nova Hollandia austr.legit Ferd.Muller in Herb.Reg. Berol.et Sonder., in ins. Van Diemen, Dr Stuart, in Herb. Sonder."

Immediately following the diagnostic description and prior to his expanded description Schuchardt cited his species as "St. Muelleri Schuch. in Herb. Sonder." In not mentioning the "Herb. Reg. Berol." it would seem best that material from Berlin (B) be excluded from lectotypification, providing syntype material suitable for this purpose is found in Herb. Sonder (MEL). Two syntypes or probable syntypes were found in MEL as indicated by annotations with this species name in Schuchardt's putative handwriting. They belong to *S. aspericocca* Schuch., as defined herein, and resemble young unbranched plants of the variant with cylindrical inflorescences and branching well above ground level. Although Schuchardt cited no specific locality for his species, the syntype collected by Stuart *(MEL503704)* comes from the Mt. Lofty Ranges in South Australia, and not from Tasmania ("Van Diemen's Land") as presumed by Schuchardt (l.c.: see discussion of typification of *S. aspericocca).* I delay selection of a lectotype until all syntypes have been located and studied and the infraspecific affinities of the plants have been determined.

Representative and cited specimens

Race 1

SOUTH AUSTRALIA (Ca. 140 specimens seen): *Alcock 2555,* 12.ix.1968, Eyre Peninsula, road between Sections 13 & 16; Hundred of Cummins, AD. — *Anon. s.n.,* xi.1889, S.Y.P. [Southern Yorke Peninsula], AD96916033 (Herb. Tate). — *Barker 553, 555,* 29.ix.1968, Southern Lofty, National Park, Belair, ca. 300 yards east of Pines Oval, AD. — *Barker 665, 667-672, 674-678, 680-682, 684-686,* 27.x.1968, Southern Lofty, Cleland Wildlife Reserve, transect from Mt Lofty Obelisk to ca. 2½ km west-north-west of it in Waterfall Gully, AD. — *Menzel s.n.,* x.1897, Mt. Lofty Ranges, AD96916031 (Herb. Tate). — *Tepper s.n.,* xi.1897, Yorke Peninsula, Ardrossan, AD96916035 (Herb. Tate). — *Wilson 813,* 8.xi.1958, Kangaroo Island, 8 km east of Rocky River homestead on South Coast Road, c. 84 km south-west of Kingscote, AD.

WESTERN VICTORIA (10 specimens seen): *Barker 1418,* 25.x.1971, ca. 23 km SSW of Casterton, ca. 4 km E of Casterton-Dartmoor road, AD.

Race 2

SOUTH AUSTRALIA (Ca. 135 specimens seen): *Alcock s.n.,* x.1963, Eyre Peninsula, Hundred of Mortlock, County Flinders, abutting section 20, AD96524036. — *Anon*[*? Behr*]*s.n.,* 28.x.-, Southern Lofty, Pf.inter P. et L. [Between Pfeiffers Section and Lyndoch Valley — see spec. leg. Behr], MEL503695 (probable syntype of *S. aspericocca*). — *Anon. s.n., s. dat.,* South-eastern, Mount Gambi[e]r, MEL503706 (lectotypus of *S. aspericocca*). — *Barker 534,* 22.ix.1968, Southern Lofty, 1½ miles west from Mt. Lofty Obelisk, AD. —

Barker 647, 14.x.1968, Yorke Peninsula, off Curramulka-Port Vincent road, Hundred of Ramsay, Section 141, AD. — *Barker 658-660, 664,* 20.x.1968, Southern Lofty, Morialta Falls Reserve, ca. ¾ mile east-north-east of kiosk, southern slopes and summit of Rocky Hill, AD. — *Barker 697-699,* 3.xi.1968, Murray, ca. 3½ miles south of Monarto South, AD. — *Barker 1454,* 27.x.1971, South-eastern, ca. 12 km by road from Keith on main Bordertown road, AD. — *Behr s.n.,* Nov., Southern Lofty, Tanunda, MEL503707 (probable syntype of *S. aspericocca*). — *Behr s.n.,* Nov., Southern Lofty, inter Pfeiffer's Section et Lyndocvalley, MEL503696 (possible isosyntype of *S. aspericocca*). — *Wheeler 1110,* 13.x.1968, Eyre Peninsula, north-east track through Hincks National Park, ca. 6 km from eastern boundary, AD. — *Wheeler 1274,* 19.x.1968, Kangaroo Island, Flinders Chase, south-west corner, ca. 6 km along road to Cape du Couedic, south of Rocky River Homestead, AD.

WESTERN VICTORIA (4 specimens seen): *Anon. s.n.,* s. dat., Nhill, AD96916024 (Herb. Tate). – *Barker 1427,* 25.x.1971, ca. 23 km SSW of Casterton, ca. 4 km E of Casterton-Dartmoor road, AD.

Race 3

SOUTH AUSTRALIA (15 specimens seen): *Barker 632, 637, 643,* 13/14.x.1968, Yorke Peninsula, ca. 6-7½ km south-south-west of the Corny Point Lighthouse, AD. — *Cleland s.n.,* 18.xi.1924, Kangaroo Island, Cape du Couedic, AD966090192 (p.p.), AD96905033 (p.p.), AD966090249. — *Cleland s.n.,* 18.xi.1924, Kangaroo Island, Rocky River, AD966090192 (p.p.). — *Eichler 15403,* 11.xi.1958, Kangaroo Island, Cape du Couedic (near the light house), AD.

Specimens of doubtful infraspecific affinities

SOUTH AUSTRALIA: *Anon.* [*? Oswald*], s. dat., South-eastern, Guichenbay. MEL503705 (material det. by Schuchardt as *S. muelleri,* but not cited in protologue). — *Stuart s.n.; s. dat.,* Lofty-range, Nov Holl austral., MEL503704 (probable syntype of *S. muelleri*).

3. **Stackhousia annua** Barker, species nova

Species nova Sectionis *Stackhousiae* Subsectionis *Racemosarum* a omnibus speciebus notis subsectionis duratione annua differt; prope *S. aspericoccam* et *S. monogynam* sed altitudine minore, cotyledonibus persistentibus et floribus coccisque minoribus etiam differt.

Herba annua glabra erecta, (5.5-)12(-19) cm alta, plerumque caule solitario, raro in partibus inferis ramosa. *Cotyledones* duo oppositae, obovato-spathulatae usque anguste obovato-spathulatae, (5-)6-9(-10.5) mm longae crassae, plerumque persistentes. *Caulis* irregulariter obtuso-angulus. *Folia* alternata simplicia sessilia crassiuscula, (7-)13-18(-27) mm longa, basi articulata, costa impressa; folia infima anguste spathulata, media anguste obovata, suprema linearia. *Stipulae* tereto-subulatae, (0.3-)0.4(-0.45) mm longae, persistentes. *Inflorescentia* spica cylindricea densiflora, usque 3(-4) cm longa, floribus secus rhachim singulariter dispositis, subsessilibus tribracteatis, pedunculo 1-3(-4) cm longo, *bracteae mediae* una ad basim pedicelli, exstipulatae vel bistipulatae, sessiles concavae ovatae eroso-serrulatae, acuminatae acutaeve, (1.4-)1.8(-2.5)mm longae, (0.6-(0.7(-1.2) mm latae, herbaceae marginibus hyalescentibus, *bracteolae* duo inaequales exstipulatae sessiles ovatae acuminatae, (0.7-)0.8-1.3(-1.4)mm longae, (0.4-)0.6-0.8(-0.9)mm latae, herbaceae marginibus hyalescentibus, ad calycem adpressae. *Calyx* campanulatus, tubo 0.7-0.9mm longo, herbaceo, lobis quinque subaequalibus concavis lanceolatis, acutis eroso-serrulatis, 1.1-1.9mm longis, 0.7-1.0 mm latis, herbaceis margine hyalescenti. *Corolla* parum zygomorpha eborina, tubo in lato adaxiali 4.0-5.2mm longo, in lato abaxiali 3.5-4.5mm longo, ad basim in ungues quinque diviso, lobis quinque inaequalibus, patentibus lanceolatibus obtusis, (3.1-)3.4-4.0(-4.5)mm longis, (1.1-)1.3-1.6mm latis. *Stamina* tres longa et duo brevia alternantia, antheris oblongis. *Gynoecium* 3-5-partitum, etiam in spica singulari quoad numerum partium varians, ovario inermi. *Cocci* immaturi rugulosi, minute colliculato-pusticulati. (Figs 3 & 4).

Holotypus (fig. 3): *W.R. Barker 633,* 13.x.1968. Ca. 6 km south-south-west of the Corny Point lighthouse. *Casuarina stricta-Alyxia buxifolia* association. Dark brown sand. Open flat terrain. Growing among grasses. From within same population, 634 (W.R. Barker) representing the 3 largest plants with longer and less fleshy leaves. AD97645535. *Isotypi:* **CANB, K, PERTH,** atque *W.R. Barker 634* (AD96905061). *Topotypus: Blaylock 1066.* (See also Typification on p. 77.)

Slender erect glabrous annual *herb*, (5.5-)12(-19)cm high. *Cotyledons* two, opposite, simple, entire, obovate-spathulate to narrow obovate-spathulate, obtuse, (5-)6-9(-10.5)mm long, thick, usually persistent, rarely caducous before flowering. *Stem* longitudinally ribbed, usually simple, rarely with branches developing singly and non-synchronously in axils of cotyledons, and then sometimes also in axils of lower leaves. *Leaves* alternate simple entire sessile, slightly tapered towards the articulated base, somewhat thick, with sunken midrib; lower leaves narrow spathulate, obtuse, (8-)13-17(-25)mm long, with or without a daedaleous opaque tip; middle leaves narrow obovate,

Fig. 3. *S. annua.* Holotype *(Barker 633,* AD).

obtuse, (10-)13-18(-26)mm long, with a longer daedaleous opaque tip; uppermost leaves linear, acute to acuminate, (7-)13-18(-25)mm long, with a opaque daedaleous tip. *Stipules* two equal terete-subulate, (0.3-)0.4(-0.45)mm long, persistent. *Inflorescence* a dense-flowered cylindrical spike, with peduncle 1-3(-4)cm long; flowers tribracteate arranged singly along flowering rachis which is up to 3(-4)cm long; *middle bract* at base of pedicel, exstipulate or bistipulate, sessile concave ovate, acuminate to acute, (1.4-)1.8(-2.5)mm long, (0.6-)0.7(-1.2)mm wide, herbaceous with a hyalescent erose-serrulate margin; *lateral bracteoles* two, on opposite sides of pedicel, unequal exstipulate sessile, appressed to calyx tube, ovate, (0.7-)0.8-1.3(-1.4)mm long, (0.4-)0.6-0.8(-0.9)mm wide, acuminate, herbaceous with erose-serrulate hyalescent margin; *pedicel* 0-0.1(-0.15)mm long. *Calyx* campanulate, with tube 0.7-0.9mm long, herbaceous, with the five lobes concave, inflexed at apex, lanceolate ± equal, 1.1-1.9mm long, 0.7-1.0mm wide, acute herbaceous, with erose-serrulate hyalescent margin. *Corolla* slightly zygomorphic, cream-white; tube divided into five free basal claws inserted upon torus alternate with calyx lobes, 4.0-5.2mm long along adaxial side, 3.5-4.5mm long along abaxial side; lobes five spreading concave lanceolate obtuse (3.1-)3.4-4.0(-4.5)mm long, (1.1-)1.3-1.6mm wide. *Stamens* five; filaments 3 long alternating with 2 short, inserted on rim of torus opposite the calyx lobes; anthers oblong. *Gynoecium* 3-5-partite, the number of carpels varying even in a single spike; carpels uni-ovulate with surface free of excrescences; ovules anatropous bitegmic tenuinucellate. Immature *cocci* obovoid, to 1.4mm long and 1mm wide, shiny rugulose, minutely colliculate-pusticulate, often showing different stages of development in a single flower, sometimes aborting. (Figs 3 & 4.)

S. annua is endemic to the near-coastal regions of south-western Yorke Peninsula and south-eastern Eyre Peninsula (fig. 4G). It may yet be found in the western part of Kangaroo Island where the flora is closely related to that found on the two peninsulas (Wood, 1930). The species occupies grey sandy soil in open grassy areas of *Melaleuca lanceolata* or *Casuarina stricta* scrub, with or without a prominent shrub understory. Its known distribution is restricted to a few populations and it may be an endangered species. The Corny Point and Daly Head populations are certainly threatened by human activity and grazing, respectively.

As an annual *S. annua* differs from all known species of Sect. *Stackhousia* Subsect. *Racemosae.*

The type population of *S. annua (Barker 633, 634)* in *Casuarina stricta* woodland lies adjacent to a population of the coastal cliff-top variant of *S. aspericocca (Barker 632)* in low heath. The two species were flowering simultaneously but no intermediates were found.

The Eyre Peninsula collection differs from the Yorke Peninsula material by the presence of prominent stipules at either side of the base of each bract (fig. 4 B,F). Further study is required to determine whether this is of taxonomic significance.

Typification of S. annua

The specimens *Barker 633 & 634* and *Blaylock 1066* were collected from the one population at the one time (the discrepancy between the descriptions of the locality given by the two collectors is erroneous). *Barker 634* is considered an isotype on the following basis. The separation of the Barker collection under two numbers in the field was a means by which the character differences of thick versus membranous leaves could be associated with the plants after the loss of the distinction in the drying process. There was also the thought at the time that the three plants in *Barker 634*, among the largest in the population, may, however unlikely, have been hybrids between *S. annua* and a neighbouring undiscovered population of *S. aspericocca* with membranous leaves, but this consideration was not confined to the three plants nor could any evidence be found for this subsequently. The exclusion of *Barker 634* from the type collection would give a biased sample of the range of variation in both the type population and the species overall (e.g. *Barker 639* contains a majority of plants much larger than in the type population).

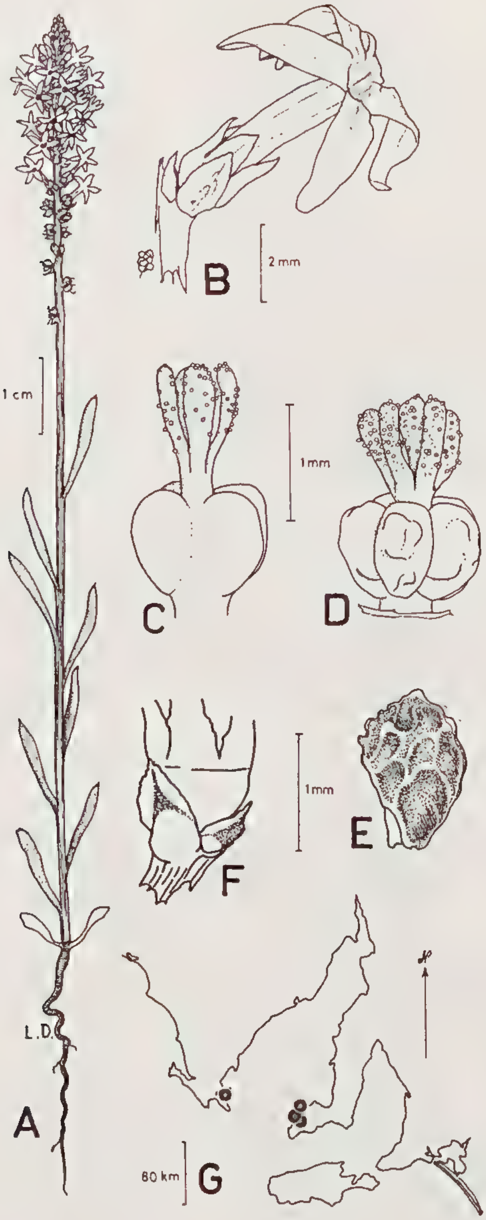

Fig. 4. S. annua. A, habit *(Barker 633)*; B, flower, with estipulate bract and prominent bracteole *(Barker 639)*; C & D, gynoecia from single inflorescence *(Barker 633, 634 or 639)*; E, immature coccus *(Barker 639)*; F, base of flower, showing stipulate bract (Eyre Peninsula collection: *Wilson 324)*; G, distribution of *S. annua*.

Specimens examined

SOUTH AUSTRALIA. EYRE PENINSULA: *Wilson 324,* 8.x.1958, Flinders Hundred, 8 km south-east of Port Lincoln, Stamford Hill, AD. — YORKE PENINSULA: *Barker 633, 634,* 13.x.1968, ca. 6 km south-south-west of the Corny Point lighthouse, AD (holo-and isotype of *S. annua*). — *Barker 639,* 13.x.1968, Daly Head, AD (topotype of *S. annua*). — *Eichler 13974,* 26.ix.1957, between Corny Point and Cape Spencer, ca 17½ km south of Corny Point and ¾km east of road to Stenhouse Bay, AD. — *Gordon & Woelkerling 3,* 22.ix. 1968, ca. 1.6 km east of Daly Head, AD.

4. **Stackhousia spathulata** Sieb. ex Spreng., Linn. Syst. Veg. (ed. 16) 4(2)(1827)124; Tate, Hdbk. Fl. Extratrop. S. Austral. (1890)29, 211; Black, Fl. S. Austral. (1926) 359, p. maj. p.; Black, Fl. S. Austral. (ed.2)(1952)537, p. maj. p. TYPE: *Sieber 246,* s. dat. Fl. Novae Holl. MEL 503697 (isotype).

This species, which is also known from coastal regions of the eastern states, is distinctive by its broadly 3-winged cocci (fig. 5), fleshy broad spathulate leaves, broad bracts and broad herbaceous bracteoles. It has a cylindrical inflorescence of cream-white flowers. It is clearly closely related to *S. aspericocca* and possibly comes closest to the coastal clifftop variant of southern Yorke and Eyre Peninsulas and Kangaroo Island. In South Australia these taxa can be distinguished on habit and floral characters in addition to the leaf and fruit differences which separate *S. spathulata* and *S. aspericocca* as a whole. *S. spathulata* branches well above the root stock, while the coastal variant *(Race 3)* of *S. aspericocca* branches only at the base of the plant. The former also tends to have a shorter corolla and stigmatic lobes. These, however, are only characteristics of South Australian specimens and the one western Victorian collection seen, for the few collections seen from New South Wales and Queensland differ by their branches arising from near ground level and their longer corollas and longer linear stigmatic lobes.

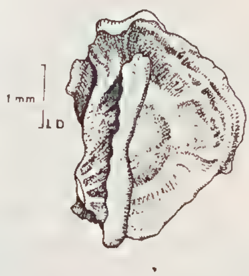

Fig. 5. *S. spathulata.* Coccus, lateral view *(Copley 3334).*

In South Australia *S. spathulata* occurs in coastal or near-coastal sand dunes or sand flats. It has rarely been collected west of the River Murray mouth. Fruiting material is required to verify the occurrence at the tip of Eyre Peninsula.

Specimens examined

SOUTH AUSTRALIA. YORKE PENINSULA: *Donner 611,* 30.ix.1962, sandhills above the beach ca. 12 km south of Yorketown, AD. — *Donner 628,* 25.xi.1962, ca. 10 km south of Yorketown, AD. — *Wollaston s.n.,* 17.xi.1968, Troubridge Point, AD. — KANGAROO ISLAND: *Cashmore s.n.,* 21.xi.1933, limestone E. of Vivonne Bay, AD96905033(p.p.). — *Cleland s.n.,* 1.ii.1940, near Rocky River on south coast, AD966090267. — SOUTH-EASTERN: *Anon. (Mt. Gambier School Wildflower Show) s.n.,* x.1937, without locality, AD966020389. — *C.D. Black s.n.,* x.1910 & ix.1913, Robe, AD96905033 (p.p.). — *Cleland s.n.,* 2.xi.1941, Port MacDonnell, AD966090266. — *Cleland s.n.,* 14.ii.1948, Cape Northumberland, AD97013082, AD966090286. — *Cleland s.n.,* 13.xi.1957, Younghusband Peninsula, AD966090287. — *Copley 3334,* 13.i.1971, Nora Creina Bay, AD. — *Fagg 206,* 24.i.1966, Lake Bonney, AD. — *Hunt 1892,* 14.ii.1964, Port MacDonnell, AD. — *E.N.S. Jackson 194,* 12.xi.1959, sandhills between Lake George and the sea near Beachport, AD. — *Robertson 1,* 26.viii.1976, beside Coorong Lagoon, 2 km S of Noonameena Camp, AD. — *Robertson 2,* 27.viii.1976, on Younghusband Peninsula opposite Noonameena Camp, AD. — *Symon 6881,* 11.iv.1971, Younghusband Peninsula, on Coorong near Meningie, AD. — *Wilson 1351,* 19.xi.1959, Cape Northumberland, ca. 3 km west of Port Macdonnell, AD.

VICTORIA. SOUTH-WEST COAST: *Whibley 72,* 22.x.1957, Cape Otway, AD.

NEW SOUTH WALES: *Brown s.n.,* 1900, Port Macquarie, AD96916012. — *Sieber 246,* s.dat., Fl.Novae Holl., MEL 503697 (isotype of *S. spathulata*).

QUEENSLAND: *Davis s.n.,* 26.viii.1955, Mooloolaba, AD95808226.

Specimens with affinites to S. spathulata

SOUTH AUSTRALIA. EYRE PENINSULA: *Rohrlach 873,* 8.x.1961, West Point area, ca. 32km south-south-east of Port Lincoln, AD. — KANGAROO ISLAND: *G. Jackson 687,* 11.x.1970, "Little Sahara sandhills", AD.

5. Sect. **Stackhousia** Subsect. **Cincinniferae** Mattf. in Engl. & Prantl, Nat. Pfl.-fam. (ed.2)20b(1942)252. Fig. 6.

There are clearly several distinct taxa belonging to this subsection in South Australia. From annotations on collections in the Tate and Black Herbaria in AD, "*S. viminea* Sm." and "*S. muricata* Lindl." of Tate (1890) and Black (1926, 1952) belong in this subsection.

The present taxonomy of Subsect. *Cincinniferae,* as summarized by Mattfeld (1942), is clearly inadequate as it does not cover the existing extensive variation in this subsection which is centred in the arid and tropical areas but extends into the temperate regions of Australia. Until the subsection is revised, it is possible neither to apply rank to the South Australian taxa nor to attribute names with any certainty. In fact, it is probable that all South Australian taxa, except the following species, are undescribed. It is important that more collections of this subsection are made throughout its range.

Although Tate (1890) recorded *S. megaloptera* FvM. from central Australia north of Lake Eyre, a study of material in the Tate Herbarium (AD) shows that he applied this name only to specimens from the Northern Territory and Western Australia. Similarly Mueller (1882, 1889) cited *S. megaloptera* from "South Australia", but this region as defined included Northern Territory south of the Tropic of Capricorn in addition to South Australia. This record was probably based only on the type location of the species in the MacDonnell Ranges of Northern Territory, although this must be verified by a research of the collections available to Mueller. Accordingly, in the absence of any further reference to the species in works covering the South Australian flora (e.g. Black, 1926, 1952; Eichler, 1965), the collection of the species *Whibley 968* (6.ix.1963, North-Western Region, Musgrave Range, ca. 65 km west of Musgrave Park, AD) represents a new addition to the state's flora.

S. megaloptera can be readily distinguished from other members of Subsect. *Cincinniferae* by its prominently winged cocci.

Fig. 6. Sect. *Stackhousia* Subsect. *Cincinniferae.* Inflorescence (*Stackhousia* sp.: *Copley 2756,* 1.viii.1969, Eyre Peninsula, Gawler Ranges, ca. 10 km north of Peterby Tank, Thurlga Station, AD).

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Index to Scientific Names

J. Adelaide Bot. Gard. 1(2): 83-106 (1977)

A TAXONOMIC REVISION OF THE GENUS *CHLOANTHES* (CHLOANTHACEAE)

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Abstract

A taxonomic revision of the genus *Chloanthes* R. Br. is provided. Four species are recognized all typified for the first time. *C. stoechadis* R. Br. var. *parviflora* Benth. is found to be synonymous with the typical variety. The affinities and distribution are considered for the genus and each species. A new key to the species is provided and a detailed revised description of each taxon is supplemented by a habit sketch of a flowering branch and analytical drawings of the flowers.

Taxonomic History of the Genus

The genus *Chloanthes* was described by Robert Brown (1810) for two species, *C. glandulosa* and *C. stoechadis,* which he had collected himself in New South Wales. It was referred to the Verbenaceae where it has been retained by the majority of botanists. Sprengel (1825) placed the genus in Linnaeus' "Didynamia Angiospermia" without reference to any family, and also described a new species, *C. lavandulifolia,* now recognized as a synonym of *C. stoechadis* R. Br. Later, Reichenbach (1828) transferred it to the tribe Verbeneae in the Labiatae. Subsequently, Bartling (1830) referred this genus to the tribe Viticeae in the Verbenaceae. This tribe was accepted for the genus by Lindley (1836), Bentham (1870) and Maiden & Betche (1916). Spach (1840) also referred this genus to the Viticeae which he termed a section.

In 1836, Endlicher placed it in the tribe Lippieae in the Verbenaceae, and this was followed by Meisner (1840), Endlicher (1841), Dietrich (1843), and Walpers (1845, 1847). Prior to 1845 the genus comprised two species, to which a new one from Western Australia, *C. coccinea,* was added by Bartling (1845) and another from eastern Australia, *C. parviflora,* by Walpers (1845). In 1847, Schauer for the first time provided a detailed description of this genus, placing it in the tribe Verbeneae of the Verbenaceae where it was retained by Lindley (1846, 1847, 1853). Subsequently, Bentham (1870) referred this genus to the predominantly Australian subtribe Chloanthinae ("Chloantheae") of the tribe Viticeae in the Verbenaceae. He also described a new variety, *C. stoechadis var. parviflora,* which is recognized here as synonymous with the type variety. In 1876, Bentham & Hooker upgraded the subtribe Chloanthinae to the tribe Chloantheae, without altering the circumscription of its genera. This tribe was accepted for the genus by Bailey (1883, 1890, 1901, 1913), Durand (1888), Post & Kuntze (1904) and Lemée (1943).

Briquet (1895) reclassified the Verbenaceae and upgraded the tribe Chloantheae to a subfamily Chloanthoideae. The latter consisted of three tribes: Achariteae, Chloantheae and Physopsideae, with *Chloanthes* in the tribe Chloantheae. This classification was adopted by Briquet (1896), Dalla Torre & Harms (1904), Junell (1934) and Melchior (1964). Diels & Pritzel (1904) revised the Western Australian Verbenaceae comprising only Bentham & Hooker's tribe Chloantheae. They subdivided the tribe into two subtribes, namely Lachnostachydinae and Chloanthinae, placing *Chloanthes* in the latter. Gardner (1931) retained *Chloanthes* in Briquet's subfamily Chloanthoideae, but within the subfamily he referred it to Diels & Pritzel's subtribe Chloanthinae without mention of the tribe Chloantheae.

Hutchinson (1959) raised the status of Bentham & Hooker's tribe Chloantheae to the family Chloanthaceae, which differed from Verbenaceae (s.str.) chiefly in the albuminous seeds. The new family for the genus was accepted by Bullock (1959, 1960), Takhtajan (1959, 1969), Eichler (1965), Symon (1969), Gardner (1972) and Munir (1975, 1976, 1977). Also in 1959, Moldenke published a résumé of the world Verbenaceae and

referred *Chloanthes* and its allied genera to the family Stilbaceae. Within this family, the genus was retained in the subfamily Chloanthoideae, tribe Chloantheae.

In 1965, Airy Shaw referred all genera of Australian Verbenaceae (s.lat.) with albuminous seeds to the family Dicrastylidaceae Drumm.ex Harv. (nom.nud.), a name mentioned incidentally by Harvey (1855) but not validated. The family name, Dicrastylidaceae, however, has been adopted for the "Australian Verbenaceae" with albuminous seeds by Airy Shaw (1966, 1973), Beard (1970), Moldenke (1971), Maconochie & Byrnes (1971), George (1972) and some others. Nevertheless, in the majority of recent publications, *Chloanthes* and its related genera have been recorded in the Verbenaceae.

In the present revision, *Chloanthes* is retained in the family Chloanthaceae (= Dicrastylidaceae Drumm. ex Harv.).

CHLOANTHES R. Brown

(From Greek *Chloros*, grass green; *anthos*, a flower; alluding to the greenish-yellow flowers of the type species.)

Chloanthes R. Brown, Prod. Fl. Nov. Holl. (1810)513; R. Br. in Flind., Voy. Terra Aust. 2, Append. 3(1814)565; Spreng., Syst. Veg. 2(1825)756; Reichb., Consp. Reg. Veg. (1828)117, no. 2904; Bartl., Ord. Natur. Pl. (1830)180; Spreng., Linn. Gen. Pl. 2(1831)479, no. 2362; Endl., Gen. Pl. 2 (1836)634, no. 3691; Lindl., Natur. Syst. Bot. (1836)278; Meisn., Pl. Vasc. 1(1840)290; Spach, Hist. Natur. Veg. Phan. 9(1840)227; Steud., Nomenc. Bot. 1(1840)352; Dietr., Synop. Pl. 3(1843) 371, no. 2869 – "Chlonanthes"; Walp., Rep. Bot. Syst. 4(1845)57; Schauer in DC., Prod. 11(1847)531; Walp., Rep. Bot. Syst. 6(1847)689; Bocq., Rev. Verbenac. (1863)130; Benth., Fl. Aust. 5(1870)44; Pfeiff., Nomec. Bot. 1(1873)721; Benth. & Hook., Gen. Pl. 2(1876)1140 p.p. [exclud. *Chloanthes lewellinii* F. Muell. (= *Dicrastylis lewellinii* (F. Muell.) F. Muell.); F. Muell., Fragm. viii: 50]; F. Muell., Syst. Cens. Aust. Pl. 1(1882)103 p.p.; Bail., Synop. Qld Fl. (1883)374; F. Muell., Sec. Syst. Cens. Aust. Pl. 1(1889)172 p.p.; Briq. in Engl. & Prantl, Pflanzenfam. 4, 3a (1895)162; Bail., Qld Fl.4(1901)1167; Dalla Torre & Harms, Gen. Siphon. (1904)431, no. 7168; Diels & Pritz., Bot. Jahrb. Syst. 35 (1904)523; Post & Kuntze, Lexic. Gen. Phan. (1904)120, 668 p.p.; Ewart, Fl. Vic. (1931)975 p.p.; Gard., Enum. Pl. Aust. Occ. 3(1931)112; Junell, Sym. Bot Upsal. 4(1934)74; Lemée, Dict. Descrip. Syn. Gen. Pl. Phan. 8b (1943)654; Bullock, Taxon 8(1959)165, 204; Hutch., Fam. Fl. Pl. 1, 2 ed. (1959)397; Mold., Résumé Verben. etc. (1959)404; Burb., Dict. Aust. Pl. Gen. (1963)68; Melch., Engl. Syll. Pflanzenfam. 12 ed. (1964)436 p.p.; Airy Shaw, Kew Bull. 8(2) (1965)256; Blackall & Grieve, W. Aust. Wildfls 3(1965)573; Harris, Alp. Pl. Aust. (1970)140; Mold., Fifth Summary Verben. etc. 2(1971)751; Beadle et al., Fl. Syd. Reg. (1972) 507; Airy Shaw, Willis's Dict. Fl. Pl. & Ferns 8 ed. (1973)244.

Type Species: C. stoechadis R. Br., Prod.Fl.Nov.Holl.(1810)513 lectotype. The genus was typified by A.A. Bullock, Kew Bull.14(1960)41.

Number of Species 4.

Description

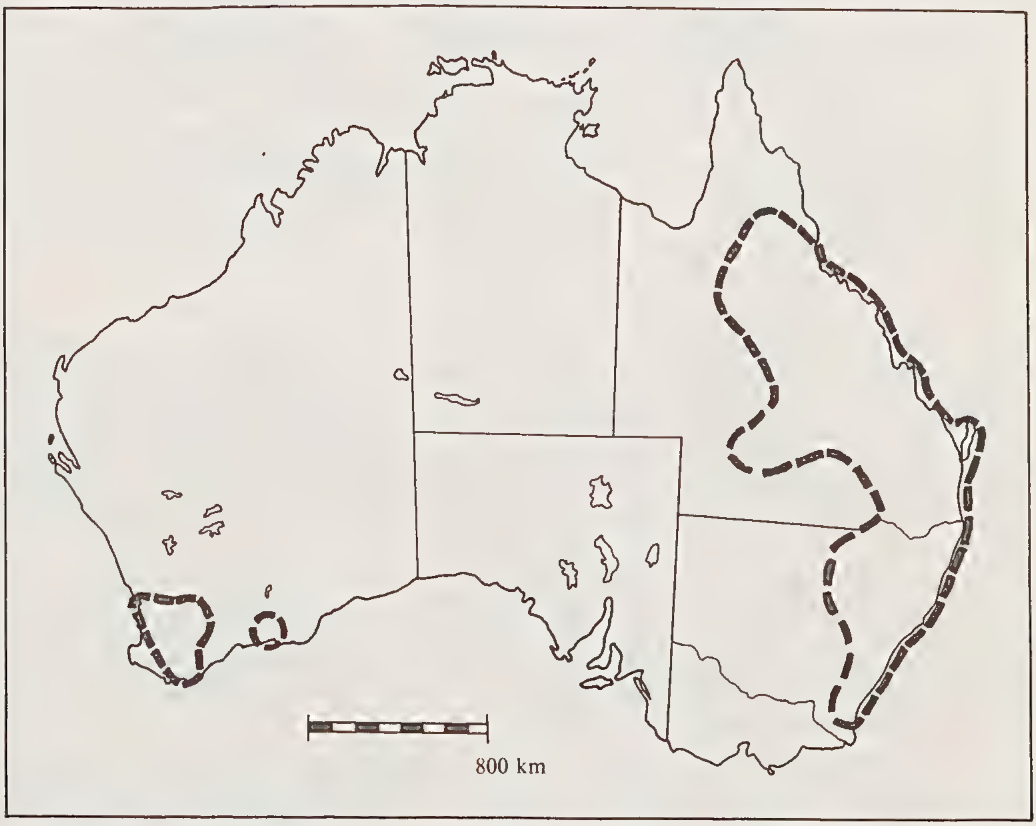
Perenial shrubs or undershrubs. *Stem* erect, branched, cylindrical, solid, woody, tomentose, concealed mainly by the decurrent leaves. *Leaves* cauline and ramal, exstipulate, simple, sessile, reticulate unicostate, decussate or in whorls of three, bullate-rugose and decurrent along the stem. *Flowers* axillary, solitary, bracteate, with two lateral bracteoles, complete, zygomorphic, bisexual, hypogynous. *Calyx* of 5 fused sepals, persistent, deeply 5-lobed, tubular below. *Corolla* of 5 fused petals, caducous, 2-lipped (or unequally 5-lobed in the upper half), tubular below, the upper lip 2-lobed, the lower lip 3-lobed; lobes spreading, the anterior one (i.e. the middle lobe of the lower lip) rather larger than the others; tube elongated, usually curved and dilated upwards. *Stamens* 4,

somewhat didynamous, epipetalous, inserted below the middle of the corolla-tube; filaments filiform, glabrous, the anterior two (i.e. beside the large middle lobe of the lower lip of corolla) longer than the posterior two; anthers dorsifixed, 2-lobed; lobes free and somewhat divergent in the lower halves, without any or with very obscure appendages at the lower end, longitudinally dehiscent. *Ovary* bicarpellary, syncarpous, 4-locular with one axile ovule in each cell; style filiform, glabrous, 2-lobed in the upper half. *Fruit* a dry 4-celled drupe, the endocarp separating into two hard 2-celled nutlets (cocci). *Seeds* solitary in each cell, albuminous.

Distribution (Map 1)

The genus *Chloanthes* is endemic in Australia. Two out of four species, *C. parviflora* and *C. stoechadis,* are restricted to Queensland and New South Wales. The third species, *C. glandulosa,* occurs in eastern New South Wales, and the fourth one, *C. coccinea,* is known from the far south-western part of Western Australia. No records are known from South Australia, Northern Territory, Victoria or Tasmania.

Moldenke (1959, 1971) and Airy Shaw (1966, 1973) erroneously recorded this genus from New Zealand.



Map 1. Distribution of the genus *Chloanthes* R. Br.

Comments

The number of species in *Chloanthes* has been considered to be much higher by a few botanists because many *Pityrodia* species and a few *Dicrastylis* were described in the past as *Chloanthes*. Bentham (1870) distinguished these genera correctly and transferred most of the species, erroneously described as *Chloanthes*, to *Pityrodia*. F. Mueller (1882, 1889), however, recorded *Pityrodia* as a synonym of *Chloanthes* and transferred all species of *Pityrodia* to the latter, recognizing 19 species. Bentham & Hooker (1876) regarded *Dicrastylis lewellinii* (F. Muell.) F. Muell. as a 5th species of *Chloanthes* and the same number of species was later mentioned by Durand (1888). Briquet (1895), Dalla Torre & Harms (1904) and Post & Kuntze (1904) each considered the number of species in the genus as 8. Similarly, Pelloe (1921) and Harris (1947) mentioned the number of species as 20 and 19 respectively, whereas Ewart (1931), Melchior (1964) and Airy Shaw (1966, 1973) each regarded the number of species as 10. It seems that F. Mueller's broad concept of this genus influenced the generic concepts of many subsequent authors, who also considered *Pityrodia* and a few *Dicrastylis* as species of *Chloanthes*. In the present revision, only 4 species are recognized in the genus.

F. Mueller (1876) described *Chloanthes bonneyana* with "*Hemistemon bonneyi* F. M. Coll." as its synonym, both based on Fred Bonney's collection (no. 2, MEL 69138) from across the Darling River. The names *Hemistemon* F. Muell. and *H. bonneyi* F. Muell. were recorded in the Index Kewensis as synonyms of *Chloanthes* R. Br. and *C. bonneyana* F. Muell. respectively. Dalla Torre & Harms (1904) and Airy Shaw (1966, 1973) also recorded *Hemistemon* F. Muell. as a synonym of *Chloanthes* R. Br. Excepting the original description, however, neither F. Mueller nor any other botanist mentioned *C. bonneyana* F. Muell. or *Hemistemon* F. Muell. as belonging to the genus *Chloanthes*. During the present investigation the holotype of *C. bonneyana* F. Muell. has been found not to be *Chloanthes* and is thus excluded from this genus. It is a poor specimen but may be near *Rostellularia* in the Acanthaceae. Both agree in their indumentum being simple and septate; corolla 2-lipped; stamens 2 with similar anthers which are distinctly appendiculate at the lower end and hairy on the back; gynoecium with similar stigma, style and external ovary characters. Since the type of *C. bonneyana* F. Muell. is without a mature flower or fruit, its identity remains uncertain.

Affinities

Chloanthes is closely related to *Pityrodia* R. Br. in having a 2-lipped corolla, 4 stamens inserted in the lower half of the corolla-tube and a bicarpellary ovary transformed into a completely 4-celled dry fruit. Nevertheless, it can be easily distinguished by its decurrent leaves, lack of appendages to the anthers and longer corolla-tube. The corolla-tube in *C. coccinea* and *C. parviflora* dilates abruptly above the calyx, but in comparison to its width, the tube is longer than in any species of *Pityrodia* R. Br.

Chloanthes is also close to *Denisonia* F. Muell. in having a similar 2-lipped corolla, 4 stamens, axillary solitary flowers towards the end of branches giving the appearance of a spike and non-accrescent fruiting calyces. However, *Denisonia* F. Muell. may be readily identified by its leaves being neither decurrent nor rugose-bullate, corolla-tube rather shorter than the calyx, stamens inserted in the upper half of the corolla-tube and anther-lobes divergent in the lower halves.

There are also a few characters shared between *Chloanthes* and *Hemiphora* F. Muell. Both genera have branched tomentum all over the plant, rugose-bullate leaves with recurved margins, axillary solitary flowers towards the end of branches, non-accrescent fruiting calyx, 2-lipped corolla and no appendages to the anthers. Nevertheless, *Hemiphora* F. Muell. can easily be distinguished by its non-decurrent leaves and only 2 fertile stamens.

Key to the Species

1. Stamens and style included (i.e. not extending past top of corolla tube). Lower lip villous inside with a few sparse and short hairs running down into the tube..1. *C. parviflora*

1. Stamens and style exserted. Lower lip glabrous inside or with a few minute hairs (in *C. coccinea*)

   2. Leaves lanceolate or linear-lanceolate with margins scarcely recurved, shortly hispid below, (3.5-) 5-7 (-8) cm x (4-)5-9(-11) mm ....4. *C. glandulosa*

   2. Leaves linear-lanceolate to almost terete owing to revolute margins, densely woolly below, less than 4(-5) cm x 3(-5) mm

      3. Corolla greenish-yellow or greenish-blue when fresh; tube gradually dilating upwards (fig. 3). Queensland, New South Wales and doubtfully Western Australia ...... 3. *C. stoechadis*

      3. Corolla scarlet when fresh; tube abruptly dilating immediately above the calyx (fig. 2). Western Australia ....2. *C. coccinea*

1. **Chloanthes parviflora** Walp., Rep. Bot. Syst. 4(1845)58; Schauer in DC., Prod. 11(1847)532 p.p. exclud.spec. *Lhotzky s.n.* N.S.W.; Benth., Fl.Aust.5(1870)46 p.p. exclud. spec. *Lhotzky s.n.* N.S.W.; F. Muell., Fragm.9(1875)5; F. Muell., Syst.Cens.Aust.Pl.1(1882)103 p.p.; Bail., Synop. Qld.Fl.(1883)374; C. Moore, Cens.Pl.N.S.W.(1884)52 p.p.; Maiden, Proc.Linn.Soc.N.S.W. Sec.Ser.4,(1889)109; F. Muell., Sec.Syst.Cens.Aust.Pl.1(1889)172 p.p.; Bail., Qld.Fl.4(1901)1168; Dixon, Pl.N.S.W.(1906)236; Domin, Bibl.Bot.89(1929)553; Ewart, Fl.Vic.(1931)1975; Mold., Resume Verben.etc.(1959)208; Harris, Alp.Pl.Aust.(1970)140 fig. 229; Mold., Fifth Summary Verben.etc.1(1971)345; Willis, Handb.Pl. Vic.2(1972)581; Beadle et al., Fl. Syd. Reg. (1972)507; Rotherham et al., Fl. Pl. N.S.W. & S. Qld.(1975)49, t.116.

Type: C. E. Hubbard 4328, Broadwater, near Brisbane, 5.x.1930 (BRI neotype designated here: BM, BR, G, K 3 spec., LE, P, NY, S, UPS, US, W - isoneotypes).

Typification

C. parviflora was described by Walpers (1845) on a dried specimen from Australia. At the end of the protologue, he mentioned "crescit in Nova Hollandia (v.s.sp.)" but did not cite any collection, collector's name or number. In 1847, Schauer recorded this species with the description and remarked: "(v.s.sp.orig.h.cl.Lucae Berol.)", which in the opinion of the present author means that Schauer himself saw the original dried specimen in the most renowned "Lucae" Berlin Botanic Gardens, but like Walpers, he too did not cite any details of the type. Elsewhere in his treatment of this species, however, Schauer cited a Lhotzky specimen. Duplicates of a Lhotzky collection are now preserved in Herb. FI, LE and P. These specimens were identified as *C. parviflora* but do not agree with Walper's protologue nor with Schauer's description of this species and are correctly identified as *C. stoechadis* R. Br. There is no possibility, therefore, that these Lhotzky's specimens are types of *C. parviflora* Walp.

During the present investigation, *Chloanthes* material has been examined from 39 herbaria, including Herb. B and G, but no specimen annotated in Walpers' hand or containing any indication of being Walpers' type has been found. According to Stafleu (1967) Walpers' own herbarium and many of the types of his new taxa were sold after his death and their present location is not known. In view of these facts, it seems very likely that the original specimen (i.e. the type) seen by Schauer in the Botanic Gardens, Berlin, was destroyed during the war and is not extant. A neotype is, therefore, selected here.

The specimen collected by Hubbard (No. 4328), now preserved in Herb. BRI, is very typical of this species, conforms in all details with Walpers' description, and is, therefore, designated here as the neotype.

Description (Fig. 1)

A shrub 30-75 (-90) cm high. *Stem* often with several branches arising from a common stock. *Leaves* pale green, linear or almost terete owing to the revolute margins, (1-) 1.5-3.5 (-4) cm long, 2-4 (-5) mm broad, rugose-bullate above, densely white woolly underneath; bullae tuberculate or muricate, the woolly undersurface often concealed by the revolute margins. *Flowers* shortly pedicellate; pedicel 1-2 (-3) mm long, woolly or pubescent with branched septate hairs; bracts leafy, sessile, linear or linear-lanceolate with revolute margins, 1-2.3 cm long, 1.5-3 mm broad, rugose-bullate above, woolly underneath, bullae pubescent, somewhat tuberculate or muricate; bracteoles sessile, linear or almost terete owing to the revolute margins, 5-10 mm long, c. 1 mm broad, rugose and pubescent above, woolly underneath. *Calyx* deeply 5-lobed, with a very short tube, 8-13 mm long, glandular and pubescent outside, pubescent on the inner face of the lobes as well, glabrous inside the tube; lobes linear or oblong-linear, with the margins revolute in the upper halves, slightly recurved in the lower halves, 7-10 mm long, 1.5-2 mm broad at the base; tube 1-2 (-3) mm long. *Corolla* pale mauve with purple spots in throat and tube, 1.5-2.5 (-3.2) cm long, glandular and pubescent outside, hairy (villous) inside on the lower lip with a few sparse and short hairs running down into the tube, a dense hairy ring inside the tube above the ovary; the anterior lobe of the lower lip much larger than the other 4-lobes, broadly elliptic or almost orbicular in outline, 8-12 mm long, 10-11 mm broad at the base; the other 4-lobes almost elliptic-oblong or ovate, 4-6(-8)mm long, 3-5(-6) mm broad at the base; tube short, abruptly dilated above the calyx, narrow towards the base, 10-15 (-20) mm long. *Stamens* 4, included, filaments (3-) 4-7 (-9) mm long; anthers more or less orbicular in outline, 1-1.5 mm long, 0.5-1 mm broad; lobes with a minute tubercle at the lower end. *Ovary* globose, c. 1 mm in diameter, densely tomentose; style included, 10-15 (-18) mm long, distinctly 2-lobed at the summit, lobes 1-2 mm long. *Fruit* oblong-obovate, occasionally almost orbicular in outline, slightly compressed, notched at the apex, puberulous with faint reticulation all over, 3-5 mm long, 2.5-3 (-4) mm broad; nutlets oblong-cylindrical.

Representative specimens

QUEENSLAND (65 specimens seen): *Althofer s.n.*, 22.5 km on Jericho — Blackall road, 11.xii.1968 (NSW 135854) *Blake 4091*, Caloundra, sandy places near creek, 23.viii.1932 (BRI). *Clemens s.n.*, base of Mt. Norman, 10.x.1944 (A, BRI 190686, NY, US). *Dallachy s.n.*, Rockingham Bay, May, 1869 (K 2 spec., MEL 69191-3&69167, NSW 135847). *Domin 8097, 8098, 8099, & 3201*, in collibus Dividing Range dictis inter opp. Jericho et Alpha, March, 1910 (PR 4 spec.). *Everist 8043*, Isa Gorge about 18 miles SW of Theodore, 25° 09'S, 149° 57'E, 28.ix.1968 (BRI, CANB, NSW). *Gittins 365*, Expedition Range, August, 1960 (BRI). *Gittins S/12*, ca. 25 miles WSW of Duaringa, July, 1964 (NSW 135853). *Hubbard 4328*, Broadwater, near Brisbane, 5.x.1930 (BRI NEOTYPE: BM, BR, G, K 3 spec., LE, P, NY, S, UPS. US. W-isoneotypes). *Hubbard 4554*, Fraser Island, 18.x.1930 (BRI, K). *Johnson 1136*, 12 miles SSE of Bluff, Blackdown Tableland, 23.ix.1959 (BRI). *Lebler & Baxter 1088A*, Helidon Hills, about 4 miles NW of Helidon, 5.ix.1968 (BRI). *Lovell s.n.*, Sandy Cape, Fraser Island, August, 1892 (BRI 190683). *Michael s.n.*, Salisbury near Brisbane 1832 (A). *Phillips s.n.*, Currimundi Creek at Golden Beach, 26° *46'S, 153°* 07'E, 13.viii.1963(CBG07145), *L. S. Smith & Everist 962*, ca 10 miles ESE of Lancevale, 23.x.1940 (A, BRI, MEL). *Telford 1955*, Witts Lookout, Paluma Range, 24.v.1970 (CBG). *White s.n.*, Fraser Island, Wide Bay, October, 1921 (A, BRI 190682). *Williams 72038*, Cooloola, 2.4 km S of Camp Como, 19.vii.1972 (BRI).

NEW SOUTH WALES (61 specimens seen): *Alee 67a*; NNE of Mongarlowe, 5.xi.1970 (NSW). *Bailey s.n.*, near Woodburn, Casino Forest, September, 1944 (NSW 135846). *Boorman s.n.*, Stockout Creek, Coledale Rd., October, 1909 (F 287164, MO 823149, NSW 135851). *Boorman s.n.*, Charlies Forest near Braidwood, September, 1915 (AD 97608118, BRI 190685, C, NSW 135852 & 135844, SYD, US 917461). *Burgess s.n.*, 29 miles from Braidwood, on the road to Nowra, 13.x.1969 (AD 97122161, CBG 031405, NT 27442) *Chippendale & Constable s.n.*, Goonoo State Forest, Dubbo—Mendooran, 25.ix.1957 (NSW 17393, US 2038458). *Conabere 333*, Red Rock, 9.x.1971 (NSW). *Forsyth s.n.*, Warrumbungle Range, October, 1899 (E, F 876724, G 2 spec., K NSW 135850, W 3642). *Johnson & Constable s.n.*, Etoo Creek, NE of Gwabegar, 3.xi.1954 (MO 1730067, NSW 30350). *Maiden & Boorman s.n.*, Grafton to Dalmorton, November, 1903 (BRI 190694, NSW 135840). *Rodd & McGillivray 1111*, 2 miles NNW of Mt Coricudgy E of Rylstone, 25.iv.1965 (NSW). *Rodway 2574*, 12 miles S of Nerriga, 19.ix.1937 (A, BRI, K). *Rupp 14*, Warialda, July, 1905 (NSW). *Streimann 185 & Telford s.n.*, 36 km ESE of Cooma, Upper Tuross River, 17.ix.1973 (CBG 050043, MEL).

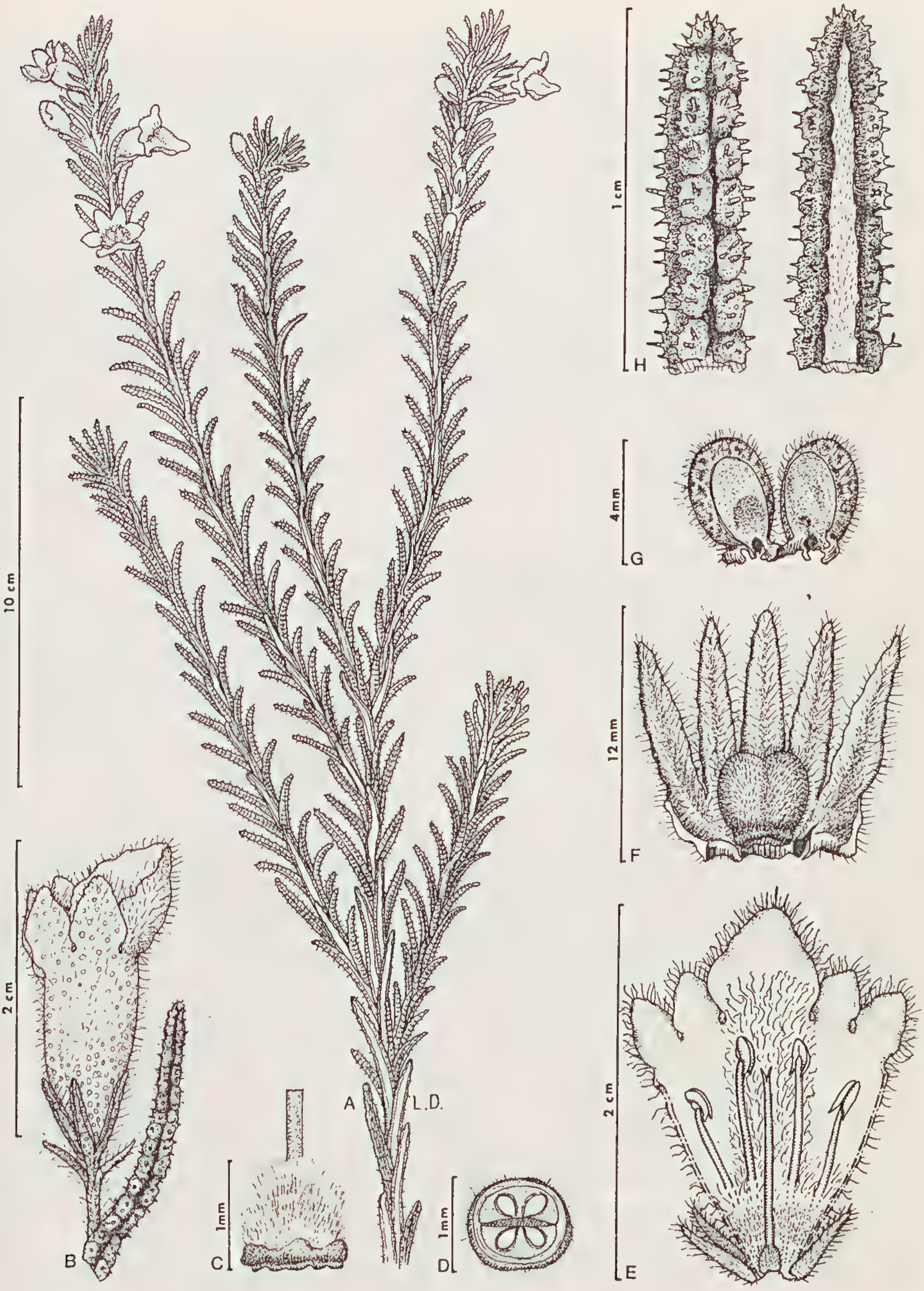
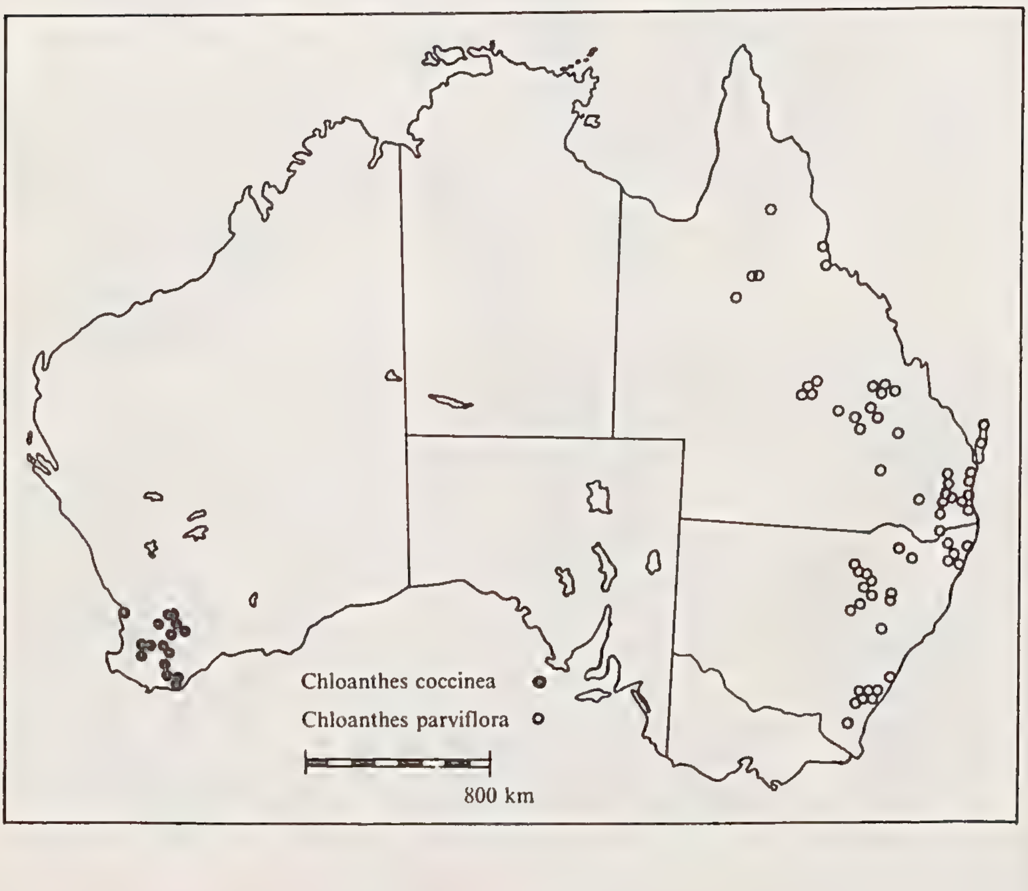


Fig. 1 *Chloanthes parviflora* Walp. *(T. L. Ryan 00009:* BRI). A, flowering twig; B, flower with bract and bracteoles; C, ovary; D, transverse section of ovary; E, flower with calyx and corolla cut open to show androecium, gynoecium and the villous lower lip; F, persistent calyx opened to show fruit; G, fruit split to show the 2 nutlets; H, adaxial and abaxial view of portions of leaf.

Distribution (Map 2)

C. parviflora is endemic in Queensland and New South Wales. The distribution in Queensland is chiefly in the eastern and south-eastern parts with a few inland localities around Jericho and Mt Norman. In the northern parts of the state, it has been recorded from the Blackdown Tableland, Halifax Bay and Rockingham Bay. Southwards, it is sparsely distributed to the west-south-west of Rockhampton, but is fairly common around Brisbane and Toowoomba. A few collections are also known from Fraser Island and the coastal area between Fraser Island and New South Wales border.

In New South Wales, distribution is restricted to the east of longitude 145°. The main northern localities are around Grafton, north of Coffs Harbour, and in the Pilliga Scrub area to the south-west of Narrabri. Moreover, a few scattered localities are to the north-north-west of Dubbo. In the south, it seems fairly common between Braidwood and Nerrigà with one record from the upper part of the Tuross River and another one from south of Sydney.



Map 2. Distribution of *Chloanthes coccinea* Bartl. and *C. parviflora* Walp.

Comments

Ewart (1931) included this species in his 'Flora of Victoria' with the remark: "very rare, if native." In this respect, Willis (1972) pointed out that "the only voucher specimen in Melbourne Herbarium came last century and is labelled "near Swan Hill"; if the species ever did occur in Victoria, it is presumed to have vanished long since." No Swan Hill specimen was included in the loan from Herb. MEL, and no collection of any species of *Chloanthes* is known from Victoria. The presence of this genus in that state has, therefore, not been confirmed.

According to Maiden (1889), *C. parviflora* occurs in the most southern limits of Clyde and Braidwood districts in New South Wales, where the sandstone formation ends. This species is common in that area, but its present distribution limit extends as far south as the upper part of the Tuross River.

Bentham (1870) was uncertain about the colour of the flower which is always mauve, purple or light blue in this species. The confusion was apparently due to his inclusion here of Lhotzky's specimen which is yellow flowered and belongs to *C. stoechadis* R. Br. Previously, the same specimen had apparently been cited under *C. parviflora* by Schauer (1847), and Bentham (1970) may not have re-examined its identification sufficiently critically.

Affinities

This species is nearest to *C. coccinea* in its broad corolla-tube being abruptly dilated above the calyx. However, *C. parviflora* can be easily distinguished by its leaves being more densely woolly underneath; corolla mauve with purple spots in throat and tube; lower corolla-lip villous inside; and stamens and style included. Moreover, *C. parviflora* is restricted to the eastern states while *C. coccinea* is endemic in the south-west of Western Australia. *C. parviflora* is also related to *C. stoechadis* in having similar leaves with dense white woolly tomentum underneath and almost the same general distribution. The latter, however, may be readily identified by its yellow flowers, narrow corolla-tube gradually dilated upwards, and exserted stamens and style.

2. **Chloanthes coccinea** Bartl. in Lehm., Pl. Preiss. 1(1845)352; Walp., Rep. Bot. Syst. 6(1847)689; Schauer in DC., Prod. 11(1847)531; F. Muell., Fragm. 6(1868)156; Benth., Fl. Aust. 5(1870)46; F. Muell., Fragm. 9(1875)5; F. Muell., Syst. Cens. Aust. Pl. 1. (1882)103; F. Muell., Sec. Syst. Cens. Aust. Pl. (1889)172; Diels & Pritz., Bot. Jahrb. Syst. 35(1904)524; Pelloe, Wildfls West. Aust. (1921)27; Domin, Mem. Soc. Sc. Boheme 1921-22, 2(1923)106; Gardner, Enum. Pl. Aust. Occ. 3(1931)112; Mold., Résumé Verben. etc. (1959)208; Blackall & Grieve, West. Aust. Wildfls 3(1965)573; Beard, Descrip. Cat. W. Aust. Pl. 2 ed. (1970)113; Mold., Fifth Summary Verben. etc. 1(1971)345; Gardner, West. Aust. Wildfls B(1972)166; Gardner, Wildfls West. Aust. 12 ed. (1975)120.

Type: L. Preiss 2339, Hay district, Western Australia, 7.xi.1840 (GOET lectotype designated here; BR, FI, HBG, KW, LD, LE, M, MEL, MO, P, W 2 spec. — isolectotypes).

Typification

C. coccinea Bartl. is based on L. Preiss's collection no. 2339, consisting of at least thirteen duplicates. Since the author did not choose any one of them as a type, it is, therefore, necessary to select a lectotype for this name. The syntype preserved in Herb. GOET, where Bartling's herbarium and types are now housed (Stafleu, 1967), was annotated by Bartling and almost certainly used by him in preparing the original description of this species. The specimen is particularly complete and well preserved. It is, therefore, chosen here as the lectotype for this species.

In the protologue the date of collection for the type is given as 7 November, 1840, and the labels of several syntypes (Herb. HBG, LD, LE and MO) bear this date. The date recorded on the label of the lectotype (in GOET) and a syntype in Herb. P is, however, 1843 and, further, the syntypes in Herb. FI and BR are dated 1846 and 1847 respectively. As Preiss left Australia in 1842 the dates of the syntypes in Herb. BR, FI and P probably refer to the year of communication of the specimens to these herbaria.

Description (Fig 2)

A branched shrub about 25-60 cm high. *Leaves* narrow-linear or almost terete owing to the revolute margins, obtuse, (0.8-)1-2.5 (-3) cm long, 2-3 (-4) mm broad, coriaceous, distinctly bullate-rugose above, very woolly underneath, bullae in two or four longitudinal rows, slightly tuberculate or muricate, shining, the white woolly undersurface usually concealed by the revolute margins. *Flowers* collected into short leafy spike-like clusters near the summit of the branches, shortly pedicellate; pedicel 2-3 (-4) mm long, sparsely glandular and puberulous; bracts leafy, sessile, linear-oblong, bullate and sparsely pubescent on the upper (i.e. inner) surface, densely white woolly underneath, revolute along the margins, 8-11 mm long, 2-2.5 mm broad; bracteoles opposite, sessile, linear-oblong, 4-6 mm long, 1-1.5 mm broad, more or less purplish, pubescent outside (i.e. underneath), glabrous inside. *Calyx* deeply 5-lobed, rarely 6-lobed, 10-13 mm long, glandular and pubescent outside with a few hairs on the inner distal parts of the lobes, glabrous inside; lobes broadly lanceolate with margins bullate and recurved, 6-8 (-9) mm long, 2-3 (-4) mm broad at the base; tube 2-3 (-5) mm long. *Corolla* scarlet, 2.5-3.5 cm long, glandular and pubescent outside, glabrous inside excepting the dense hairy ring above the ovary, and with minute hairs extending to the large anterior-lobe; the (two) lobes of the upper lip oblong-ovate, obtuse, (3-) 4-6 mm long, 2-4 (-5) mm broad at the base; the two lateral lobes of the lower-lip oblong-ovate, 4-7 (-8) mm long, 3-5 mm broad at the base; the anterior-lobe of the lower lip almost orbicular, 8-10 mm in diameter; tube almost cylindrical towards the base, abruptly dilated above the calyx, 1.5-2 cm long, 8-10 mm in diameter in the upper half. *Stamens* 4, exserted; filaments (8-) 11-15 mm long; anthers 1-1.5 mm long, 0.5-1 mm broad. *Ovary* more or less globose, 1-2 mm in diameter, densely tomentose; style exserted, 2-2.5 cm long. *Fruit* more or less globose, 3-5 mm long, 3-4 mm in diameter, pubescent.

Specimens examined

WESTERN AUSTRALIA: *Ashby s.n.*, Lake Grace to Newdegate Road, 10.vii.1963 (AD 96428135). *Ashby 247*, Tarin Rock, west of Lake Grace, 12.viii.1963 (AD). *Ashby 1292*, Tarin Rock, 26.x.1964 (AD). *Ashby 1952*, loc. cit., 7.ix.1966 (AD). *Ashby 1984*, Duggan, 30 km west of Lake Grace, 3.x.1960 (AD). *Ashby 3634*, Tarin Rock, 9.ix.1970 (AD). *Ashby 5250*, loc. cit., 11.ix.1975 (AD). *E. Ashby s.n.*, Kondinin to Wagin, Sept. 1930 (ADW 14618, NSW 135856). *E. Ashby 2701*, Kondinin to Wagin, Sept. 1930 (BM). *Brewer s.n.*, loc. incert., 1878 (UC). *Broadbent 133*, Duggan, 19.x.1952 (BM). *Clyne s.n.*, Narrogin towards Lake Grace, 11.x.1969 (NSW 135855). *Cronin s.n.*, Sources of the Blackwood River, 1888-9 & 1892 (MEL 69145, 69147-8). *Cronin s.n.*, Lake Wagin, N. of King George's Sound, 1890 (MEL 69235). *Drummond Coll. III no. 142*, "Swan River", 1844 (BM, CGE, FI, G 2 spec., GH, K. KW, MEL, W). *Drummong 97*, loc. incert., undated (MEL 69141-2). *Drummond s.n.*, loc. incert., undated (MEL 69143-4). *Knight s.n.*, Gordon River, undated (MEL 69149). *Kuchel 2008*, 15 km north-east of Kukerin, 20.ix.1964 (AD). *Lukin s.n.*, Fremantle, 1874 (MEL 69146). *Meebold 6896*, Broomehill, Etna Farm, Nov. 1928 (BR, M 2 spec.). *F. Mueller s.n.*, Gordon River, 9.ix.1894 (C, M, MEL, NY, W). *Muir s.n.*, 100 miles north of Stirling Range, 1879 (MEL 69237). *Preiss 2339*, district Hay, 7.xi.1840 (GOET lectotype; BR, FI, HBG, KW, LD, LE, M, MEL, MO, P, W 2 spec.). *Resch s.n.*, Armadale district, "Spring" 1956 (MEL 69150). *Rogerson 61*, between Kulin and Jitarning, Dec. 1961 (MO). *D. Smith s.n.*, Bridgetown to Kojunup and Slab Hut Gully, 1910 (K, PR 530707). *Vaughan s.n.*, near King George's Sound, 1901 (BM). *Walter s.n.*, Blackwood River, undated (NSW 135857). *Webb s.n.*, King George's Sound, 1880 (MEL 69238). *Whibley 3340*, between Kulin and Corrigin, 22.x.1969 (AD). *Whibley 5306*, 25 km west of Lake Grace near Tarin Rock, 11.xi.1974 (AD).

Distribution (Map 2)

This species is endemic in the far south-west of Western Australia. The main areas of its occurrence are in the South Western Province of Gardner and Bennetts (1956) where it seems to be restricted between latitude 32° and 35° S. and between longitude 116 ° and

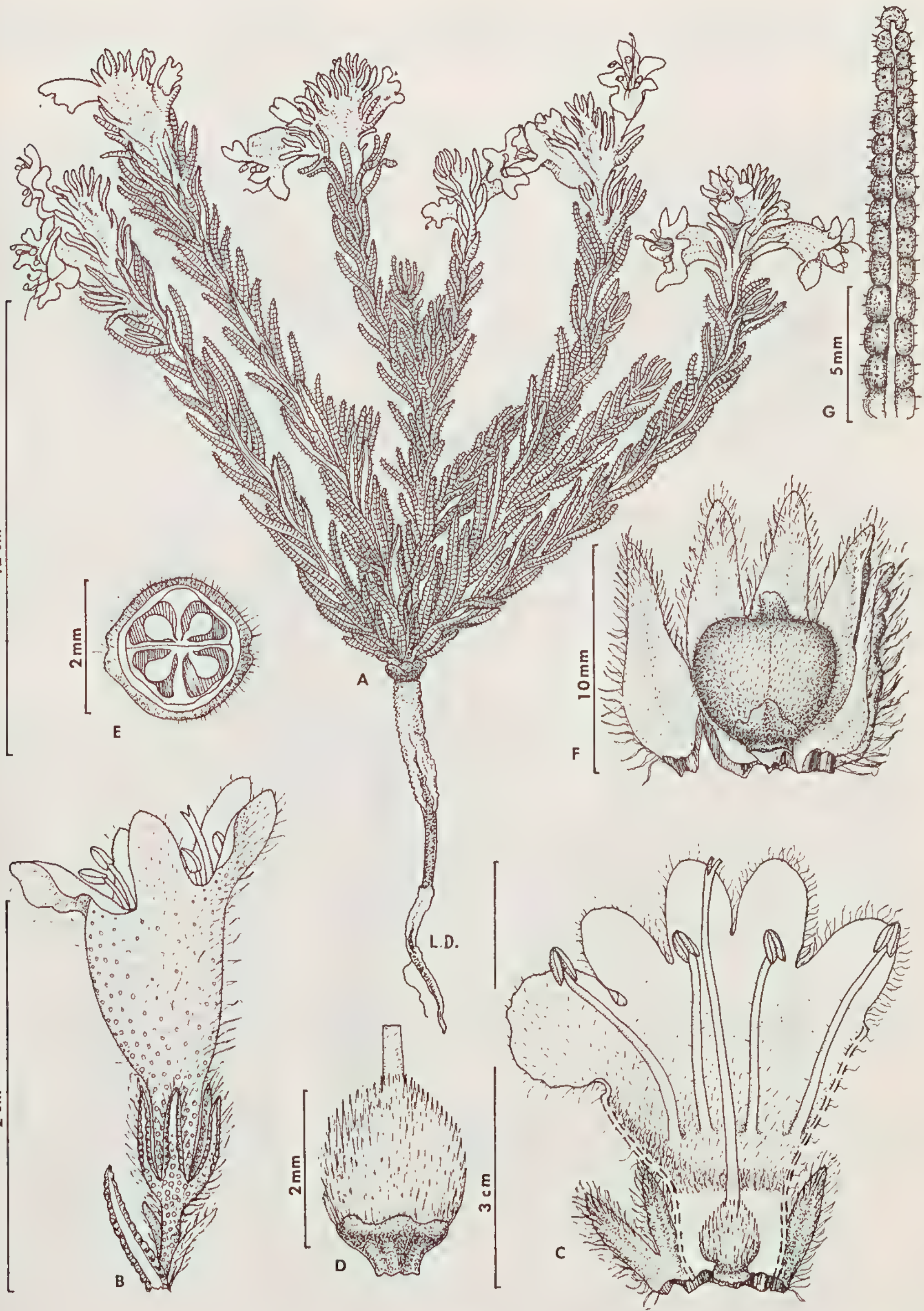


Fig 2. *Chloanthes coccinea* Bartl. *(R. H. Kuchel 2008:* AD). A, habit drawing; B, flower with bract and bracteoles; C, flower with calyx and corolla cut open to show androecium and gynoecium; D, ovary; E, transverse section of ovary; F, persistent calyx opened to show fruit; G, abaxial view of portion of leaf.

119° E. It is common between Lake Grace and Kukerin and between Corrigin and Kulin. In the south, the distribution is mainly between Katanning and King George's Sound with a few localities between Bridgetown and Kojonup.

Comments

The size of plant is not mentioned in the original description nor by any collectors. Plant height given here is, therefore, estimated from the herbarium specimens examined. Bentham (1870) probably did the same when he recorded it as a "shrub of about 1 to 2ft."

The locality recorded for *Drummond Coll. III no. 142* is "Swan River" where this species has not otherwise been collected. It was probably gathered far to the south-east of the Swan River near the Stirling Range or the Porongurups Range where this species is known to occur commonly and which area was visited by Drummond during his third collecting expedition in 1844 (Erickson, 1969). The dates on the duplicates of this collection also refer to the years of their distribution.

C. coccinea is the only geographically disjunct species, separated by over 2,500 km to the west from the main distribution area of the genus.

Affinities

C. coccinea is closely related to *C. parviflora* in its broad corolla-tube being abruptly dilated above the calyx. Nevertheless, it may be readily identified by its leaves being more rigidly and regularly bullate above, less densely tomentose beneath; corolla scarlet with the lower-lip glabrous inside; and stamens and style exserted. *C. coccinea* is endemic in the far south-west of western Australia whereas *C. parviflora* is restricted to eastern New South Wales and Queensland.

3. **Chloanthes stoechadis** R. Br., Prod. Fl. Nov. Holl. (1810)514; Spreng., Syst. Veg. 2(1825)756; Walp., Rep. Bot. Syst. 4(1845)57; Schauerin DC., Prod. 11(1847)532; Bocq., Rev. Verben. (1863)131, pl.111, figs 15-24; F. Muell., Fragm. 6(1868)156; Benth., Fl. Aust. 5(1870)45; F. Muell., Syst. Cens. Aust. Pl. 1(1882)103; Havil., Proc. Linn. Soc. N.S.W. 2 Ser. 1(1886)1051; F. Muell., Sec. Syst. Cens. Aust. Pl. 1(1889)172; Briq. in Engl. & Prantl, Pflanzenfam. 4, 3a(1895)162, fig. 61 E & F; Dixon, Pl. N.S.W. (1906)236; Petrie, Proc. Linn. Soc. N.S.W. 37 (1912)229; Petrie, Proc. Linn. Soc. N.S.W. 50(1925)159; Junell, Sym. Bot. Upsal. 4(1934)74, fig. 124a-d; Harris, Wild Fls Aust. (1947)159, t. 12; Mold., Résumé Verben. etc. (1959)208, 211; Mold., Fifth Summary Verben. etc. 1(1971)345; Beadle et al., Fl. Syd. Reg. (1972)507.

Type: R. Brown s.n., Port Jackson, New South Wales, Australia, 1802-5 (BM lectotype designated here; E 7 spec., F, G, K 2 spec., LE 2 spec., MEL 2 spec., P 5 spec. — isolectotypes).

C. lavandulifolia Sieber ex Spreng., Syst. Veg.2(1825)756; Steud., Nomen. Bot.1(1840)352; Walp., Rep.Bot.Syst.4(1845)58.

Type: Sieber 185, Novae Hollandiae, 1823 (BM, BR, FI, G, GH, HEID, K, LE, 2 spec., M 2 spec., MEL 2 spec., PR, W 4 spec. — syntypes).

C. stoechadis R. Br. var. *parviflora* Benth., Fl.Aust.5(1870)46; Bail., Qld Fl.4(1901)1168; Maiden & Betch, Cens N.S.W.Pl.(1916)177; Mold., Résumé Verben. etc.(1959)208; Mold., Fifth Summary Verben. etc.1(1971)345. *Syn.nov.*

Type: A. Cunningham 40, Wooloomooloo, N.S.W., vii.1817(K syntype); *Mossman 119,* Waverley Hills, Sydney, 1850(BRI, E, FI, K, LE, P — syntypes).

"*C hispida* Burges": Mold., Résumé Verben. etc. (1959) 208, 274; Mold., Fifth Summary Verben. etc. 1 (1971)345, 467, nom.nud. (Based on A. Burges's collection (s.n.) gathered in October, 1931, from (Sydney) National Park, now preserved in Herb. NY).

Fig. 3 *Chloanthes stoechadis* R. Br. (*R. Brown s.n.:* E). A, flowering twig; B1, & B2, adaxial and abaxial views of an enlarged leaf portion; C, flower with bract and bracteoles; D, flower with calyx and corolla vertically opened to show androecium and gynoecium; E, persistent calyx opened to show fruit; F, fruit split to show the 2 nutlets; G, ovary; H, transverse section of ovary.

"*C. rosmarinifolia* A. Cunn.": Mold., Résumé Verben. etc. (1959) 208; Mold., Fifth Summary Verben. etc. 1 (1971) 345, nom.nud. (Probably based on an Allan Cunningham collection from New South Wales, but this has not been located).

C. parviflora auct. non Walp.: Schauer in DC., Prod. 11 (1847) 532 p.p. quoad spec. *Lhotzky s.n.*, N.S.W.; Benth., Fl. Aust. 5 (1870) 46 p.p. quoad spec. *Lhotzky s.n.,*; F. Muell., Syst. Cens. Aust. Pl. 1 (1882) 103 p.p.; Moore, Cens. Pl. N.S.W. (1884) 52 p.p.

Typification

C. stoechadis R. Br. is based on R. Brown's collection (s.n.) from New South Wales, consisting of at least 21 duplicates, all of which remained in Brown's possession until after his death. On his death, his herbarium passed by bequest to J. J. Bennett who kept it at the British Museum and began the distribution of duplicates (Stearn, 1960). The main and probably the best set was retained at the British Museum and the second and third sets went to Kew and Edinburgh herbaria (Stafleu, 1967). A syntype of this species in Herb. BM was annotated by R. Brown and almost certainly used by him in preparing the original diagnosis of this species. The specimen is particularly complete and well preserved and is therefore selected here as the lectotype for this species. The number 2334 was given to this collection by Bennett.

Description (Fig 3)

Branched shrub 30-60 (-90) cm high. *Leaves* narrow-linear, linear-lanceolate or almost terete owing to the revolute margins, (0.5-) 1-4(-5) cm long, (1-)2-3(-5) mm broad, rugose-bullate above, with bullae scabrous-muricate owing to the thick basal portions of the broken off septate hairs, white woolly underneath. *Flowers* sub-sessile or on very short pedicels; pedicel 1-3 (-4) mm long, pubescent; bracts leafy, sessile, linear-lanceolate with revolute margins, 8-17 mm long, 1.5-3 mm broad, rugose-bullate above, woolly underneath, bullae pubescent, somewhat scabrous-muricate; bracteoles sessile, linear, with recurved margins, 3-6 mm long, c. 1 mm broad near the base, slightly rugose above and along the margins, sparsely pubescent all over. *Calyx* deeply 5-lobed with a relatively short tube, (7-)9-13 mm long, glandular and densely tomentose outside, pubescent on the inner face of the lobes, glabrous inside the tube; lobes lanceolate or ovate-lanceolate, recurved-revolute along the margins, bullate, 5-7 (-9) mm long, 1.5-2(-3) mm broad; tube 2-4 mm long. *Corolla* greenish-yellow, or greenish-blue (1.8-) 2-3.5 (-4.5) cm long, sparsely glandular and pubescent outside, glabrous inside except a ring of dense woolly hairs above the ovary; the upper lip somewhat concave, comprising two short spreading lobes, (4-)6-10 (-12) mm long; lobes ovate or ovate-orbicular, obtuse, (2-) 3-5 mm long, 2-4 (-5) mm broad at the base; the lower lip divided into three spreading lobes, lobes oblong-ovate or more or less elliptical, the middle one rather longer and more reflexed than the others, (6-) 8-13 mm long, (3.5-) 4-6 (-8) mm broad at the base, the other two lobes 4-7 (-9) mm long, 2.5-4 (-5) mm broad at the base; tube gradually dilated upwards, (1.5-) 2-3 cm long. *Stamens* 4, exserted, filaments (5-) 10-15 (-23) mm long; anthers ± oblong, 1.5-2 mm long, c. 1 mm broad. *Ovary* more or less globose, 1 mm long, 1-1.5 mm in diameter, densely tomentose; style much exserted, (1.8-) 2-3.5 (-4.5) cm long, distinctly 2-lobed at the summit, lobes 1.5-2.5 (-3) mm long. *Fruit* broadly elliptic-obovate, slightly compressed, separating into two hemispherical reticulate hairy cocci (nutlets), (3-) 4-5 mm long, 4-5 mm across in the upper half.

Representative specimens

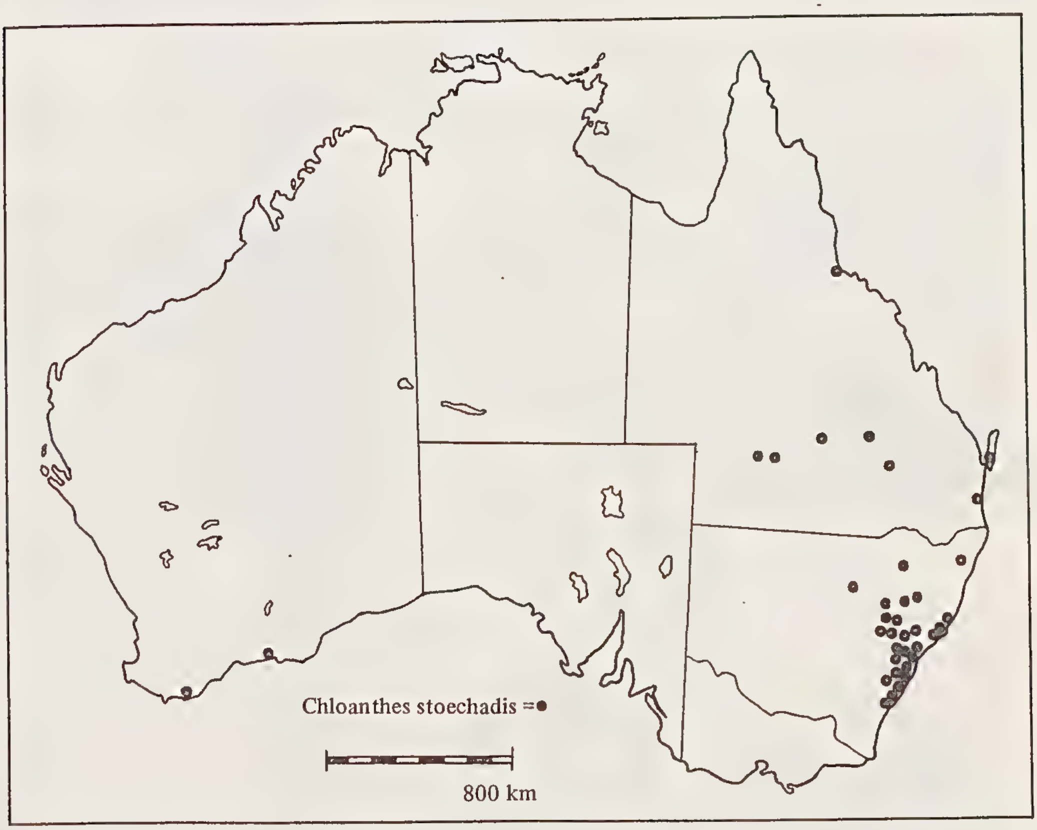
WESTERN AUSTRALIA: *Hügel s.n.*, King George Sound, undated (W). *Maiden s.n.*, Esperance, November, 1909 (C).

NOTE: The above collections are the only record of this species from Western Australia. These localities are nearly 2500 km west of its general range.

QUEENSLAND (12 specimens seen): *Camfield s.n.*, Como, August, 1897 (NSW 135872). *Clark 1*, Oxford Downs, 16.vii.1949 (P). *Hooker s.n.*, Moreton Bay, 1835 (K). *F. Mueller s.n.*, Hinchinbrook Mt., undated

(MEL 69194). *Rupp s.n., Herb. Rodway no. 6819,* Warrabeen, December, 1916 (NSW). *Unknown collector s.n.,* Fraser Island or Great Sandy Island, 1824 (A, E, W 2 spec.).

NEW SOUTH WALES (156 specimens seen): *M. Anderson s.n.,* Port Jackson, 1832 (G, GOET). *Baudin s.n.,* Port Jackson, 1801 (BR, E, FI, K, LE, NY 3 spec., US, WU). *Boorman s.n.,* Port Jackson District, June, 1903 (E, GH). *Boorman s.n.,* Nelson's Bay, August, 1911 (G, NSW 135883). *I. P. Burgess 91,* Forster, 20.x.1961 (NSW). *C. Burgess s.n.,* Red Rock, north coast, 10.v.1970 (AD 97123124, CBG 035236, NT 28705). *R. Brown s.n. (J. J. Bennett no. 2334),* Port Jackson, 1802-5 (BM lectotype; E 7 spec., F, G, K 2 spec., LE 2 spec., MEL 2 spec., P 5 spec. — isolectotypes). *Carolin 3691,* Myall Lakes, 1.ix.1963 (SYD). *Carolin 4423,* The Castle, Budawang Range, Kalianna Ridge, 15.xii.1964 (SYD). *Constable 16594,* Mt Tomah to Bell, Blue Mountains, 6.x.1950 (MO, NSW, US). *Constable 4034,* eastern end of tunnel, Cox's Gap, ca. 25 miles S. of Merriwa, 10.viii.1962 (B, NSW, S). *A. Cunningham 40,* Wooloomooloo, July 1817 (BM, K 2 spec., syntypes of *C. stoechadis* R. Br. var. *parviflora* Benth.). *Day s.n.,* Killara, May, 1936 (CANB 10289). *Forrest s.n.,* Cook's River, August, 1892 (BRI 190693). *Gauba s.n.,* Jervis Bay, 14.vii.1950 (AD 97007269, CBG 2943 & 2945). *I.A.S. Johnson 1716, 13 miles E. of Curraris Mt Gap, 8 miles E. of Olinda, 31.viii.1951 (NSW), Leichhardt s.n.,* Ballimore, 8.viii.1843 (NSW 135864). *Maiden & Boorman s.n.,* Grafton to Dalmorton, November, 1903 (NSW 135885). *McKee s.n.,* east of Rylstone, 30.ix.1951 (SYD) *Mossman 119,* Waverly hills, Sydney, 1850 (BRI, E2 spec., FI, K, LE, P — syntypes of *C. stoechadis* R. Br. var. *parviflora* Benth.). *Richards s.n.,* 6 miles south of Forster on road to Bulahdelah, 21.vii.1966 (CBG). *Rodway 11562,* Mt Bulwarra, 4 miles west of Wandandian, 4.viii.1940 (NSW). *Rodway 6816,* Dee Why, 20.x.1934 (NSW). *Shoobridge s.n.,* 31 miles from Nerriga on Nerriga Tomerang Rd, 28.x.1962 (CBG). *Sieber 185,* Nova Hollandia, 1823 (BM, BR, FI, G, GH, K, LE 2 spec., M 2 spec., MEL 2 spec., PR, W4 spec. type of *C. lavandulifolia* Sieber ex Spreng). *Sieber 186,* loc. cit., 1823 (BM, BR, F, FI, GH, HBG, K 2 spec., KW, LD, LE, M 2 spec., MEL 2 spec., MO, NY, PR, S, W 7 spec.). *Story 7562,* Fire trail between Putty and Rylstone, between Mt Munundilla and Mt Coricudgy, 21.x.1960 (CANB, NSW). *Willis s.n.,* Khyber Pass, ca. 24 miles E. of Rylstone, 5.x.1959 (MEL 69206). *Wrigley s.n.,* Kuringai Chase, 7.i.1970 (CBG 036000).



Map 3. Distribution of *Chloanthes stoechadis* R. Br.

Distribution (Map 3)

C. stoechadis is restricted chiefly to New South Wales with some scattered localities in the southern and eastern parts of Queensland and only two records from near the southern coast of Western Australia. The latter are nearly 2500 km west of its general range.

In New South Wales, the main distribution is between latitude 30° and 36° S. and longitude 149° and 153° E. It is fairly common in the Blue Mountains and in the coastal region between Jervis Bay and Newcastle. A few well-spread localities are to the north of the Blue Mountains and also to the north and north-west of Newcastle. Of these, the northern-most records are from near Grafton and Narrabri and the western-most are along the Castlereagh river.

There are two records of this species from Western Australia; Maiden's collection (s.n.) from Esperance and Hügel's (s.n.) from King George Sound. However, if the species ever did occur in Western Australia, it is unlikely that it still does.

Comments

Bentham (1870) described the small-flowered plants of this species as a new variety, *parviflora.* During the present investigation, however, small and large flowers were found to be present on plants from the same area and in some cases in the same collection. There seems to be a continuous gradation in the size of flower within the species, and no additional character has been found in the plants with the smaller flowers to justify their segregation as a variety. In view of this, Bentham's var. *parviflora* is recorded here as a synonym under var. *stoechadis.*

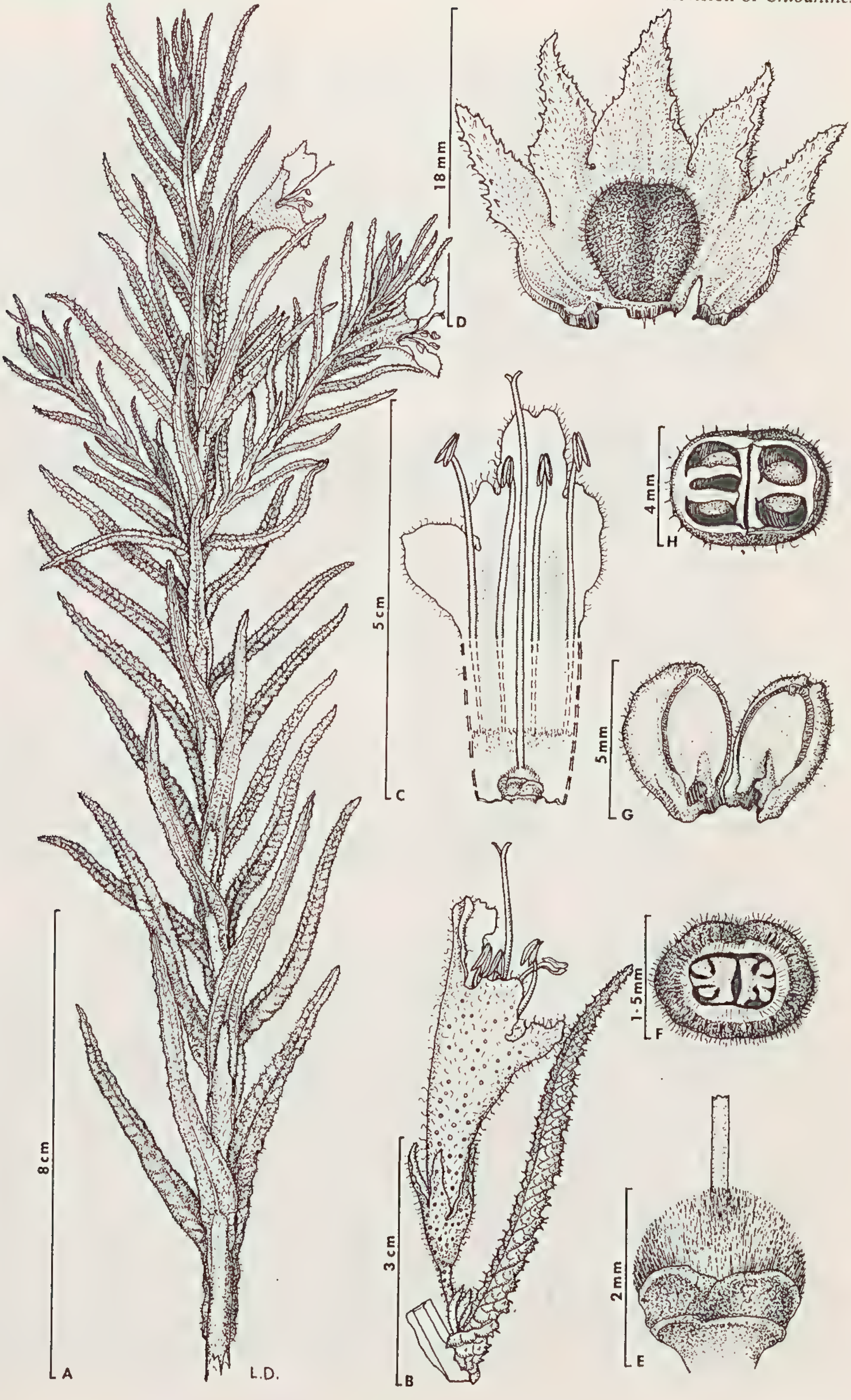
The collecting dates are not recorded with Sieber's collections, but according to Maiden (1908), "he collected in New South Wales for seven months during the year 1823, and took considerable and excellent collections to Europe, which he sold in numbered sets bearing the labels 'Flor.Nov.Holl.' or 'Pls.Exot.' ".

Walpers (1845) provided the first detailed description to this species and Schauer (1847) was the first to recognize *C. lavandulifolia* Sieb.ex Spreng. as conspecific with *C. stoechadis.* Similarly, Bauer (1813) prepared the first habit sketch and analytical drawings of the flower and fruit of this species. Subsequently, Bocquillon (1863) published his own detailed drawings of its flower and fruit with a sketch of a calyx hair and the floral diagram. Bocquillon's drawings of the un-dissected flower and its vertical section were republished by Briquet (1895). Since then, the only new habit sketch and revised analytical drawings of the flower and fruit of this species are those presented in this work.

According to Petrie (1912), *C. stoechadis* gave a negative result when tested to show the presence of hydrocyanic acid.

Moldenke (1959, 1971) erroneously recorded this species from New Zealand.

Fig 4. *Chloanthes glandulosa* R. Br. *(E. F. Constable s.n.:* NSW 55731). A, flowering twig; B, flower with leafy bract and small bracteoles; C, flower with corolla vertically opened to show androecium and gynoecium; D, persistent calyx opened to show fruit; E, ovary; F, transverse section of ovary; G, fruit split to show the 2 nutlets; H, transverse section of fruit showing albuminous seeds.


18 mm
D
5 cm
C
4 mm
H
5 mm
G
1·5 mm
F
8 cm
A
L.D.
3 cm
B
2 mm
E

Affinities

C. stoechadis is closely allied to *C. glandulosa* in its flower being greenish-yellow, corolla-tube gradually dilated upwards and stamens and style exserted. Moreover, both the species occur together in eastern New South Wales. *C. stoechadis,* however, can be easily distinguished by its leaves being narrow-linear or almost terete owing to the revolute margins, densely white woolly underneath and mostly up to 4 cm by 3 mm. It is far more wide-spread within New South Wales and is also known from southern Queensland where *C. glandulosa* does not occur.

C. stoechadis is also related to *C. parviflora* in having similar leaves with dense woolly tomentum underneath and almost the same general distribution. The latter, however, may be easily identified by its mauve corolla with purple spots in throat and tube; lower corolla lip villous inside; corolla tube abruptly dilated above the calyx; and stamens and style included.

4. **Chloanthes glandulosa** R. Br., Prod. Fl. Nov. Holl. (1810)514; Spreng., Syst. Veg. 2(1825)756; Steud., Nomenc. Bot. 1(1840)352; Walp., Rep. Bot. Syst. 4(1845)58; Schauer in DC, Prod. 11(1847)531; Benth., Fl. Aust. 5(1870)45; Mold., Résumé Verben. etc. (1959)208; Mold., Fifth Summary Verben. etc. 1(1971)345; Beadle et al., Fl. Syd. Reg. (1972)507.

Type: R. Brown s.n., Bank of the Grose River, New South Wales, Australia, 1802-5 (BM lectotype designated here; BM, E, K, MEL, isolectotypes; Port Jackson, FI, P, syntypes).
C. stoechadis R. Br. var. *glandulosa* (R.Br.) F. Muell. ex Maiden & Betche, Cens. N.S.W. Pl. (1916)177 — based on *C. glandulosa* R. Br.

Typification

C. glandulosa R. Br. is based on R. Brown's collection (s.n.) from New South Wales, consisting of at least 7 duplicates, all of which remained in Brown's possession until after his death. On his death, his herbarium went to the British Museum where the main set is still held. A complete and well preserved syntype of this species in Herb. BM, annotated by R. Brown, and almost certainly used by him in preparing the original diagnosis of this species, is selected here as the lectotype. (For additional information see typification under *C. stoechadis* R. Br.)

Description (Fig. 4)

A "bushy" shrub 30-90 cm high. *Leaves* lanceolate or linear-lanceolate, scarcely recurved along the margins, (3.5-) 5-7 (-8) cm long, (4-) 5-9 (-11) mm broad, bullate-rugose, shortly hispid on both sides, not woolly underneath, the primary and secondary veins prominent on the under surface. *Flowers* pedicellate; pedicel 4-7 mm long, glandular and pubescent; bracts leafy, muricate; bracteoles sessile, linear-lanceolate or linear-oblong, (3-)5-8 mm long, 1-1.5 mm broad, pubescent outside (i.e. underneath), glabrous inside (i.e. above). *Calyx* deeply 5-lobed, 15-18 (-20) mm long, glandular and pubescent outside with a few hairs on the inner distal parts of the lobes; lobes ovate-lanceolate with margins more or less crenate and recurved, 8-12 mm long, (2-) 3-5 mm broad at the base; tube 3-5 (-7) mm long. *Corolla* greenish-yellow or "greenish-cream," (3.5-) 4-5 cm long, sparsely glandular and pubescent outside, glabrous inside excepting the dense hairy ring above the ovary; the (two) lobes of the upper-lip with a shallow cleft at the summit, more or less ovate, obtuse, 8-10 (-12) mm long, 5-7 mm broad at the base; the two lateral-lobes of the lower-lip more or less deltoid, (2-) 3-4 mm long, 5-7 mm broad at the base; the anterior-lobe of the lower-lip almost rotundate, 7-10 mm in diameter; tube cylindrical towards the base, gradually dilated upwards, 2-2.7 cm long. *Stamens* 4, much exserted; filaments 1.5-2 (-2.5) cm long; anthers 2-3 mm long, 1-1.5 mm broad. *Ovary* globose, 1-2 mm in diameter, densely tomentose; style exserted, 3.5-4.5 cm long, minutely 2-lobed at

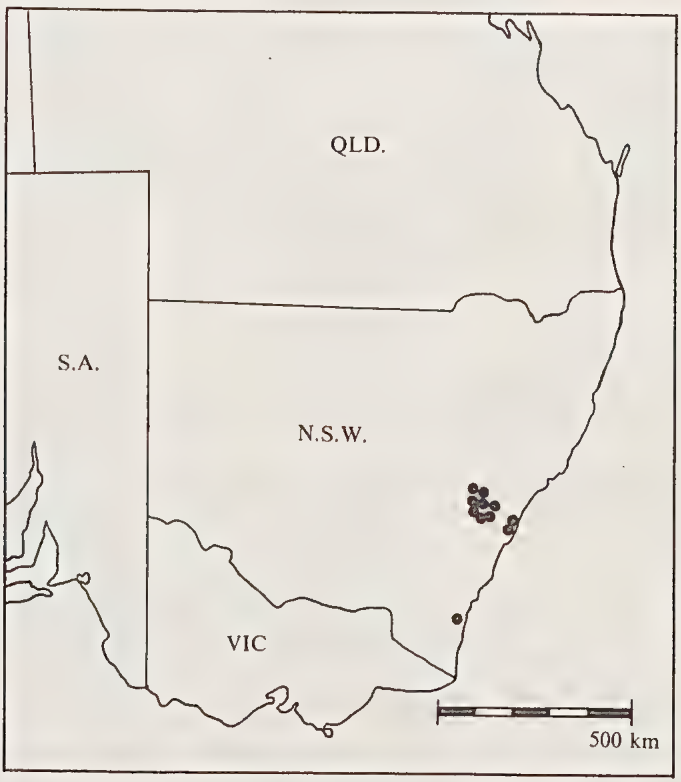
the summit. *Fruit* more or less elliptic-obovate, 5-6 mm long, 4-5 mm in diameter in the upper half, pubescent with faint reticulation all over, separating vertically into two hemispherical nuts, each nut 2-celled.

Specimens examined

NEW SOUTH WALES: *Bauer s.n.*, Port Jackson, undated (W). *Bowden s.n.*, Linden Creek, Faulconbridge, July 1968 (NSW 135860). *Brown s.n.*, Bank of the Grose river, 1802-5 (BM lectotype; BM, E, FI, K, LE, MEL, P-isolectotypes). *Conabere 373*, Blue Mountains, 1972 (NSW). *Constable s.n.*, Martin Place Road, ½ mile west of Linden Railway Station, Blue Mountains, 31.x.1960 (AD 97113090, ADW 36974, BRI 118951, CANB 187808, MEL 69151, NSW 55731, W 10837). *A. Cunningham s.n.*, Blue Mountains, 3.ix.1822 (K); Novae Hollandiae, loc. incert., 1820 (BM, CGE); Springwood, undated (BM). *R. Cunningham s.n., Mt. Tomah, 1835 (E3 spec., K2 spec.). Fraser s.n.*, Port Jackson, 1817 (A, BM). *King s.n.*, Springwood, Blue Mountains, 1893 (MFL 69153-4). *Mackey s.n.*, loc. incert., undated (BM) *Pearce s.n.*, Birdwood Gully, Springwood, 1961 (NSW 135859). *Salasoo 1503*, Tabrac Ridge. Kurrajong Heights, 27.xii.1956 (NSW). *Sieber 581*, Port Jackson, 1823 (BM, MO, P, W). *Sturgess 1*, Tuross River Mountains 3.i.1944 (NSW).

Distribution (Map 4)

C. glandulosa is known chiefly from the Blue Mountains in New South Wales. A few collections are from Port Jackson (i.e. Sydney) and one from the mountain area of the Tuross River. The latter is the southernmost locality being disjunct from the main distribution area by over 300 kilometres.



Map 4. Distribution of *Chloanthes glandulosa* R. Br.

Comments

Maiden and Betche (1916) recorded this species as *C. stoechadis* var. *glandulosa* F. Muell. Mueller is not known ever to have made this combination, and the reason for their attributing it to him has not been established with certainty.

The size of plant is not mentioned in the original diagnosis nor in any subsequent description of this species. The height of the plant is known only from the notes with a recent collection by E.F. Constable (no. NSW 55731).

Flowers of *C. glandulosa* are always pedicellate but, being axillary, they are often concealed by the subtending leaves and therefore superficially look sessile.

The accompanying illustration is the first to be published of this species.

Affinities

C. glandulosa is nearest to *C. stoechadis* in its flower characters and distribution, but may be readily distinguished by its leaves being lanceolate, the margins almost flat or scarcely recurved, shortly hispid on both sides, more distinctly bullate above, not woolly underneath and mostly above 4 cm by 3 mm. Though these species occur together in eastern New South Wales, *C. stoechadis* is far more widespread within that state and is also known from southern Queensland.

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Index to Collections

Collectors' names are in alphabetical order, and their numbers (in Arabic numerals) are followed by the numbers (in Roman numerals) given below to each species. T represents holo-, lecto- or neo-type of the species indicated.

Chloanthes parviflora	=	I
C. coccinea	=	II
C. stoechadis	=	III
C. glandulosa	=	IV

Alee 67a/I. — *Althofer* s.n., NSW 135854/I. — *M. Anderson* s.n./III. — *N. J. Anderson* s.n./III. — *Armstrong* s.n., NSW 135866/III. — *Ashby* 247/II; 1292/II; 1952/II; 1984/II; 3634/II; s.n.; AD 96428135/II; s.n., ADW 14618/II; s.n., NSW 135856/II. — *Atkinson* 10/III. — *Audas* s.n., MEL 69189/III. — *Bailey* s.n., BRI 190678/I; s.n., BRI 190680/I; s.n., MEL 69165/I; s.n., NSW 135846/I. — *Baird* 5176/I. — *Backhouse*

328/III. — *Baker* s.n., US 268954/I, s.n./III. — *Banks & Solander* s.n./III. — *Baudin* s.n./III. — *Bäuer* s.n./III; s.n./IV. — *Bäuerlen* 431/I; 357/III. — *Bawrlen* s.n., NSW 135842/I; *Benzeville* 6/I; 428(3)/III. — *Biddulph* 51/I; s.n., MEL 69217/I. — *Blake* 4091/I; 4148/I. — *Blakely s.n.*, NSW 135874/III. — *Blakely & Shiress* s.n., NSW 135840/I. — *Boorman* s.n., NSW 135841/I; s.n., NSW 135844/I; s.n., NSW 135845/I; s.n., NSW 135851/I; s.n., NSW 135852/I; s.n./III; s.n., NSW 135883/III. — *Bowden* s.n., NSW 135860/IV; s.n., NSW 135882/III. — *Brass* s.n./III. — *Brewer* s.n./II. — *Broadbent* 133/II. — *Brown* s.n./IIIT; s.n./IVT. — *Browne* s.n., NSW 135849/III. — *Burgess* s.n., CBG 023854/I; s.n., CBG 031405/I; s.n., CBG 006696/I; s.n, CBG 035065/I; 91/III; s.n./III; s.n, CBG 003108/III; s.n. CBG 009425/III; s.n., AD 97123124/III; s.n., CBG 035236/III. — *Burrows* 6717/15/I. — *Caley* s.n./III; s.n., NSW 135876/III. — *Camfield* s.n./III; s.n., NSW 1349951/III; s.n., NSW 135872/III. — *Carolin* 3691/III; 4423/III. — *Chapman* s.n./III. — *Chippendale* s.n., NSW 135878/III. — *Chippendale & Constable* s.n., NSW 17393/I. — *Chiswick* s.n., MEL 69204/III. — *Clark* 1/III. — *Cleland* s.n., AD 97608119/I; s.n., AD 97608120/III. — *Clemens 42848/I;* s.n., BRI 190686/I. — *Clowes* s.n., F 362834/III. — *Clyne s.n.*, NSW 135855/II. — *Conabere* 333/I; 373/IV. — *Constable* 4034/III; 4301/III; 48911/III; 16594/III; 26598/III; 48911/III; s.n., AD 97113090/IV; s.n., AD 36974/IV; s.n., BRI 118951/IV; s.n., MEL 69151/IV; s.n., NSW 55731/IV; s.n., W 10837/IV. — *Coveny* 2998/III. — *Cronin* s.n., MEL 69145/II; s.n., MEL 69147/II; s.n., MEL 69148/II; s.n., MEL 69235/II. — *A. Cunningham* 40/III; 107/III; 208/III; s.n./III; s.n./IV. — *R. Cunningham* s.n./III; s.n./IV. *R. Cunningham & Hooker* s.n./III. — *Dallachy* s.n., NSW 135847/I. — *Dämel* s.n., NSW 135863/III. — *Day* s.n., CANB 10289/III. — *Deane* s.n., NSW 135862/III. — *Dixon* 236.9.A/III; s.n., NSW 135879/III. — *Domin* 3201/I; 8097/I; 8098/I; 8099/I. — *Drummond* 97/II; 3rd Coll. no. 142/II; s.n., MEL 69143/II; s.n., MEL 69144/II. — *Einar & Rietz* 46/I. — Evans s.n./III; s.n./III. — *Everist* 1986/I; 8043/I; 8075/I. — *Fischer* s.n., W 51542/III. — *Fletcher* s.n./III. — *Ford* s.n., NSW 135871/III. — *Forrest* s.n., BRI 190693/III. — *Forsyth* s.n./III; s.n., NSW 135850/I; s.n., MEL 69169/I. — *Francis* s.n., NSW 135838/I; s.n., US 654108/III. — *Fraser* 293/I; s.n./IV. — *Gauba* s.n., AD 97007269/III; s.n., CBG 02943/III; s.n., CBG 02945/III. — *G(P)oeffer* 176/III. — *Gittins* 365/I; S12/I; T41/I.

Gordon 20/I. — *Grayson* s.n., NSW 135880/III. — *Harm* s.n./III. — *Harnett* s.n., NSW 135843/I. — *Harris* s.n./III. — *Harrold* 145/I. — *Helms* s.n., NSW 135877/III. — *Henderson, Andrews & Sharpe* 577/I. — *Hockings* s.n./I. — *Hochreutiner* 3142/III. — *Hooker* s.n./III; s.n./III. — *Houneman* 208/III. — *Hubbard* 3061/I; 4328/IT; 4554/I; 7846/I. — *Hügel* s.n./III; s.n./III; s.n./III. — *Johnson* 1136/I; s.n., NSW 17396/I; 401/III; 1716/III; s.n./III; s.n., MEL 69202/III; s.n., NSW 135870/III. — *Johnson & Constable* s.n., NSW 16097/I; s.n., NSW 30350/I. — *Kenney* s.n., BRI 190689/I; s.n., BRI 190691/III. — *King* s.n., MEL 69153/IV; MEL 69154/IV. — *Knight* s.n., MEL 69149/II. — *Kuchel* 2008/II. — *Lachlan* s.n./III. — *Lamont* 342/III. — *Lander* 274/I. — *Leichhardt* s.n., MEL 69190/III; s.n., NSW 135864/III. — *Labler & Baxter* 1088A/I. — *Lovell* s.n., BRI 190683/I. — *Lhotzky* s.n./III. — *Lindquist* s.n./III. — *Lister* s.n./III; s.n./III. — *Lithgow* 67/III. — *Lowne* s.n./III. — *Lukin* s.n., MEL 69146/II. — *Mackey* s.n./IV. — *Maiden* s.n./III. — *Maiden & Boorman* s.n., NSW 135840/I; s.n., NSW 135885/III. — *Mauritzon* s.n./III. — *McGillivray* 1450/I. — *McKee* 149/I; 7463/I; s.n./III; s.n./III. — *McKie* 335/I. — *McLuckie* s.n./III. — *Meebold* 2760/III; 6896/II. — *Michael* s.n./I; 1953/III. — *Mitchell* 285/I; 593a/I; 593b/III. — *Moore* 1928/I; 1949/I. — *Morris* 14/III. — *Morrow* 10/I; 14/I. — *Morrison* 5550/III. — *Mossman* 119/III. — *F. v. Mueller* s.n., MEL 69160/I; s.n., MEL 69164/I; s.n./II; s.n., MEL 69194/III; s.n., MEL 69197/III. — *Muffet* M3/190/I. — *Muir* s.n., MEL 69237/II.

Pearce s.n., NSW 135859/IV. — *Pedley* 1372/I. — *Peter* s.n./III. — *Phillips* s.n., CBG 028541/I; s.n., CBG 028542/I; s.n., CBG 07145/I; s.n./I. — *Prager* s.n., US 808539/III. — *Preiss* 2239/IIT; *Prime* s.n./III. — *Pullen* 2020/I. — *Pulley* 113/III. — *Resch* s.n., MEL 69150/II. — *Richards* s.n./III. — *Reitz & Einar* 765b/III; 4017:1/III. — *Rodd* s.n., NSW 135869/III. — *Rodd & McGillivray* III/I. — *Rodway* s.n./I; 1332/III; 2203/III; 2574/I; 6807 & 6808/I; 6810-6819/III; 11562/III; 14609/I. — *Rogerson* 61/II. — *Rupp* 14/I; s.n./I; s.n./III. — *Ryan* 9/I. — *Salasoo* 691/III; 1503/IV. — *Sarrand* s.n., NSW 135835/I. — *Sharp & Durrington* 316/I. — *Schomburgk* s.n./III. — *Schoobridge* s.n./III; s.n. CBG 013094 & CBG 013095/I; s.n., CBG 012980/I; s.n., CGB 013096/I; s.n., CBG 014922/I. — *Sieber* 185/III; 186/III; 581/IV. — *Simmonds* 374/I. — *Simmons* 15/I. — *D.A. Smith* 4/I. — *D. Smith* s.n., PR 530707/II. — *L.S. Smith* 320/I; 14819/I. — *L.S. Smith & Everist* 962/I. — *Stephenson* 309/III. — *Stewart* 199/III. — *Story* 7562/III. — *Strange* s.n./III. — *Streimann* 185/I; 843/III. — *Sturges* 1/IV. — *Sutton* 2215/III. — *Swain* 7039/13/I. — *Swartz* s.n./III. — *Telford* 246/III; EMC 923/III; 1443 & 1485/I; 1955/I; s.n., CBG 050043/I.—*Telinek* 130/III. — *Thomas* s.n./III. *Thorn* 27/III. — *Vaughan* s.n./II. — *Verreaux* 364/III. — *Vickery* 4307/III. — *Vicary* s.n./III. — *Walter* s.n., NSW 135857/II.

Webb s.n., MEL 69238/II. — *Weber* s.n./III. s.n./III. — *Wedd* s.n., BRI 190690/I. — *Weinthal* s.n./III. — *Wescombe* s.n., CBG 010269/I. — *Whaite* 2936/I. — *White* s.n./I; s.n., NSW 135834/I; 1005/I; 8453/III; 11364/I. — *Wilhelm* s.n., MEL 41220/III. — *Wilcox* s.n., MEL 69166/I. — *Williams* 72038/I; s.n., BRI 121424/I; s.n., BRI 013392/III. — *Willis* s.n., MEL 69174/I; s.n., MEL 69205 & MEL 69206/III. — *Whibley* 3340/II; 5306/II. — *Wools* 2a-f/III. — *Wright* s.n., MO119210 & US9978/III. — *Wrigley* s.n., CBG 036000/III.

Index to Scientific Names

Names

New names and combinations are in bold. Synonyms, misapplied, misspelt or illegitimate names are in italics.

Page numbers

Page numbers in bold refer to the main taxonomic treatment. Page numbers asterisked refer to figures and maps.

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THE SPECIES OF *MALVA* L. AND *LAVATERA* L. (MALVACEAE) NATURALIZED IN SOUTH AUSTRALIA

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Abstract

Two species of *Malva* L., *M. parviflora* L. and *M. nicaeensis* All., both from southern Europe and Asia Minor, are naturalized today in South Australia. A key distinguishing them is provided. Schomburgk's early accounts of the species of *Malva* naturalized in South Australia are discussed. *M. verticillata* L. and *M. pusilla* Sm. are excluded from the present-day naturalized Australian flora, the published records of these species by Black and Eichler for South Australia being the result of misidentifications of collections of *M. parviflora;* characters separating these species are provided. The variation in the two species in South Australia is compared with published accounts of their variation in Eurasia and elsewhere.

Four species of *Lavatera* L. occur in South Australia; *L. plebeia* Sims, a variable native species widespread throughout the state; *L. arborea* L., a naturalized southern European species common in the settled areas; *L. cretica* L., a rare species from southern Europe and Asia Minor whose status as a member of the naturalized flora of the state is established; and *L. assurgentiflora* Kell., a Californian species, whose existence in Australia in the Meningie-Coorong area is confirmed, but whose status as a truly naturalized species is in question. A descriptive key to the four species is provided.

The publication of the treatments of *Malva* L. and *Lavatera* L. in recent floras of Europe (Dalby, 1968; Fernandes, 1968), Turkey (Cullen, 1967) and Iran (Riedl, 1976) has enabled the taxonomy of the Eurasian species of these genera introduced into South Australia to be reassessed. The two genera are very closely related, and the distinction between them on the basis of the partial fusion or freedom of the epicalyx segments, in *Lavatera* and *Malva* respectively, breaks down in the European flora (Fernandes, 1968). This character, however, satisfactorily separates the two genera in South Australia.

The purpose of this paper is to clarify the taxonomy of the naturalized South Australian species of the two genera. A taxonomic investigation of the polymorphic native *Lavatera plebeia* Sims over its range of distribution is also desirable (Eichler, 1965).

The study is based on the collections in the State Herbarium of South Australia (AD), the Waite Agricultural Research Institute (ADW), and the reference herbarium of the Department of Agriculture, Adelaide.

MALVA L.

Bentham (1863) noted that four European species, *M. rotundifolia* L. (=* *M. pusilla* Sm.), *M. parviflora* L., *M. verticillata* L. and *M. sylvestris* L., had become naturalized as weeds in some parts of Australia, and gave characters diagnostic of each. Schomburgk (1871, 1878) listed these and several other species of *Malva* as growing in the Adelaide Botanic Garden, and subsequently (Schomburgk, 1879, 1889) noted that the four species had escaped from gardens and "established themselves [in South Australia], as in the old country, about hedges, roadsides, and in cultivated, as well as in waste grounds and pasture lands".

*Riedl (1976) argues that the earlier name *M. rotundifolia* L., synonymous with *M. pusilla* Sm. but rejected by many as a *nomen ambiguum*, should be reinstated as the correct name for this species. The former name certainly does not seem to warrant rejection under the newly revised *Article 69* of the International Code of Botanical Nomenclature (see *Taxon* 25 (1976) 172).

In order to judge the true identity of the four species listed by Schomburgk (1879, 1889) and to establish their status as truly naturalized plants, appropriately annotated South Australian collections from the period are required. No such specimens have been located in the South Australian herbaria, including the Schomburgk Herbarium in AD, but a search of the holdings of any of a number of herbaria, particularly at Melbourne and Kew, may prove fruitful.

Of the four species only *M. parviflora* today occurs in South Australia (see below). *M. sylvestris* could well have become established for a time in the state, for it is naturalized in the eastern states of Australia (Bailey, 1899; Curtis, 1975; Willis, 1973) and is so very distinctive by its large flowers that Schomburgk could hardly have mistaken it. *M. verticillata* (called by its synonym '*M. crispa* L.' by Schomburgk: see Dalby, 1968) is unlikely to have become naturalized in Schomburgk's time in South Australia, in view of the fact that it was excluded without explanation from Schomburgk's (1889) second weed list. In fact, Bentham (1863) appears to have wrongly applied the name *M. verticillata* to specimens of *M. parviflora* in the same way as later South Australian authors (see below), for his *M. verticillata* had mericarps identical to *M. parviflora*. Schomburgk may have followed Bentham in misapplying the name. Nevertheless, it is possible that *M. verticillata* was grown in Australian gardens at the time, as it is cultivated in Europe as a salad vegetable (Dalby, 1968) and a "green manure" (Mr C. Williams pers. comm. 22.i.1977). The name *M. rotundifolia* was probably wrongly attributed to *M. nicaeensis* All., the only other *Malva* species naturalized today in South Australia (see below), for Willis (1973) has noted a similar misapplication by past authors in Victoria.

Black (1909, 1926) considered *Malva* in South Australia to comprise two naturalized species, *M. nicaeensis* All. and *M. parviflora* L., both of which occur naturally in southern Europe and Asia Minor (Cullen, 1967; Riedl, 1976). Subsequently, two additional species, *M. verticillata* L. of China and naturalized in Europe (Hegi, 1925; Dalby, 1968) and *M. pusilla* Sm. of Europe and Asia Minor, were added to the South Australian flora by Black (1952) and Eichler (1965), respectively.

The rejection of M. verticillata *and* M. pusilla *from the present-day South Australian flora*

On the basis of Dalby's (1968) treatment of *Malva* in Europe, it is clear that only *M. parviflora* and *M. nicaeensis* occur today in South Australia. Neither *M. pusilla* nor *M. verticillata* are represented in the many collections seen from the state. These latter two species are related to *M. parviflora* by their narrow epicalyx segments. *M. verticillata* is distinguished from *M. parviflora* by its longer petals (ca. 7 mm) and the usually weakly ridged, sometimes smooth dorsal surface and entire angles of its mericarps, while *M. pusilla* differs by its only slightly accrescent calyx, its usually longer fruiting pedicels (more than 10 mm), and the entire, sharp but unwinged angles of its mericarps.

Specimens in AD from South Australia identified by Black (sheets *AD97612234, AD97612177* p.p.) and subsequent botanists as *M. verticillata* clearly belong to *M. parviflora*. Similarly, Willis (1973) recognized that a Victorian specimen previously assigned to *M. verticillata* should be correctly identified as *M. parviflora*. Since no other current Australian state flora includes *M. verticillata* the species is apparently to be excluded from at least the present-day naturalized Australian flora. It is also possible that the New Zealand biennial attributed to *M. verticillata* (Allan, 1940) is also misidentified material of *M. parviflora;* the mericarps are described as being "rough on backs". The characters used in Black (1952) and Eichler (1965) to distinguish *M. verticillata* and *M. parviflora* show no correlation. The misapplication of *M. verticillata* seems to have arisen from both the ability of South Australian plants of *M. parviflora* to perennate, unlike plants in Europe (see below), and the lack of emphasis in previous European works (e.g. Hegi, 1925; Clapham, Tutin & Warburg, 1952) on the only weakly sculptured mericarps

of *M. verticillata*. In such works characters present not only in *M. verticillata*, but also in South Australian *M. parviflora*, such as robust habit, densely clustered short-pedicellate flowers and, in some works, biennial duration (only annual in other texts), are given equal diagnostic weight to the mericarp characters. The sculpturing of the mericarps in *M. parviflora* in all material examined is very uniform, and stands out against the high variability of vegetative characters. Riedl (1976) has noted a similar contrast in variability of fruit and vegetative characters in *M. rotundifolia (= M. pusilla)*.

The only recent record of *M. pusilla* in the South Australian and Australian flora (Eichler, 1965) was based on an identification in 1962 by Mr C. C. Townsend (Kew Botanic Gardens) of the collection *Cleland AD96122031* made in 1961 from Victor Harbour. The specimen bears flowers and a few very young fruits. All pedicels are very short (2-3 mm) and the sepals are externally shortly stellate-pubescent, not long ciliate as described by Dalby (1968) for *M. pusilla*. The specimen agrees in all available attributes with *M. parviflora* and, there being no other species in Australia with which it could be confused, I conclude that it must belong to that species.

The variability of M. parviflora *and* M. nicaeensis

Judging from treatments of *Malva* in Eurasia (e.g. Hegi, 1925; Dalby, 1968; Cullen, 1967; Riedl, 1976), *M. parviflora* and *M. nicaeensis* are much more variable in South Australia than in their native habitat. Thus in South Australia both species perennate frequently, in both erect and prostrate forms, probably surviving for up to several years. Eurasian treatments refer to the two species as being annuals, although Dalby (1968) reports *M. nicaeensis* as an annual or biennial. The prostrate habit of these species is not noted in Europe (Dalby, 1968; Hegi, 1925; Clapham, Tutin & Warburg, 1952) or Turkey (Cullen, 1967), or in many of the floras seen of regions where the two species are naturalized. Such a habit is described, however, for *M. parviflora* in Iran (Riedl, 1976: only annual), South Africa (Henderson & Anderson, 1966; only perennial), New Zealand (Connor, 1951; only biennial), Victoria (Ewart, 1931; only annual), New South Wales (Beadle, Evans & Carolin, 1972: only annual) and Queensland (Everist, 1974: no duration stated), and for *M. nicaeensis* in Tasmania (Curtis, 1975: "annual or short-lived perennial"). Prostrate plants are widespread in South Australia, at least in the non-arid areas, for example about the suburbs of Adelaide (*M. nicaeensis: Barker 1865-1867, 1875, 1876, 1881; M. parviflora: Barker 1868, 1874, 1877, 1878, 1880)*, about Victor Harbour *(M. nicaeensis: Cleland AD97310072, AD97310074; M. parviflora: Cleland AD96122032, AD97310071, AD97310073)*, and near Curramulka (*M. parviflora: Barker 1883)*. At the Adelaide and Curramulka sites studied, this habit has developed in each species from frequent trampling and/or mowing. It appears to be a purely environmental effect, since originally prostrate plants in the absence of mowing or trampling may develop erect branches, and *vice-versa*. Populations with small first-year to large robust-stemmed perennating plants of both erect and prostrate forms are well-represented by the mass collections *Barker 1877, 1878-1880, 1883* for *M. parviflora*, and *Barker 1876* for *M. nicaeensis*.

In *M. parviflora* there is notable variation in pedicel length, uncorrelated with other characters. Dalby (1968) has placed great importance on this character to distinguish species of *Malva* in Europe, and he describes *M. parviflora* as having fruiting pedicels "usually less than 10mm long". In South Australian and Northern Territory collections, longer pedicels up to 15(30) mm long are relatively common, although pedicels less than 10 mm long are the more frequent. The long pedicels may be confined to occasional (first-formed) fruits in clusters of otherwise short-pedicelled flowers and fruits (e.g. *Alcock 3731, Blaylock 922, Copley 4485)* or be consistent throughout the whole plant (e.g. *Cleland AD966031265)*.

A study of several sites in the suburbs of Adelaide showed that *M. parviflora* and *M. nicaeensis* frequently occur together *(Barker 1865-1881).* While the two species are very similar in habit and leaf size and shape when growing side by side, the diagnostic characters of epicalyx shape and the margin and degree of fusion of the mature mericarps remain absolutely correlated (see key). In *M. nicaeensis* at these sites and in the collections in AD, however, the characters of petal length and possibly indumentum type and length show a range of variation wider than in its natural habitats in Eurasia. Thus, European plants are reported as having petals 10-12 mm long (Hegi, 1925; Dalby, 1968), as do the introduced populations in California (Munz & Keck, 1959). Remarkably, in plants from Turkey, where *M. nicaeensis* is also considered native, petals are 6-8 mm long (Cullen, 1967). In South Australia, however, petal length in *M. nicaeensis* is much more variable at (4)7-11(12) mm. In South Australian specimens with shorter petals the indumentum on the outer surface of the calyx (excluding the epicalyx and margin) is also shorter (often less than 0.5 mm), and there is a tendency for the spreading stellate hairs characteristic of *M. parviflora* to occur on the outer surface of the calyx. Riedl (1976) reports for Iran only the 1-2-armed hairs (cilia) on the calyx of *M. nicaeensis,* and stellate hairs in *M. parviflora.* It is not clear from the literature, however, whether *M. nicaeensis* elsewhere in the world has only 1-2-armed erect hairs on the outer surface of the calyx, but this applies to the only European specimen seen. Clearly a study is required of variation in these characters in *M. nicaeensis* throughout its present range of distribution, supplemented by observations of variation in both sympatric and allopatric populations of other species of *Malva.* It is noteworthy that interspecific hybrids occur in *Malva* in Europe (Dalby, 1968, 1975), and that Dalby (1975) considers it "possible that the apparent variability in some species is due, at least in part, to hybridization".

The two naturalized species of *Malva* in South Australia are distinguished as follows (the key including that variation in *M. nicaeensis* described above):

Key to the naturalized species of Malva *in South Australia*

1a. Epicalyx segments 0.8-3 times as long as broad. Outer surface of calyx with 1-2 armed erect hairs, each arm (0.2).4-1.2(1.5)mm long, rarely mixed with spreading stellate hairs. Petals (4)7-11(12) mm long. Mericarps closely appressed to each other in mature fruit, with angles on dorsal surface sharp but not winged, entire .... *M. nicaeensis* All.

1b. Epicalyx segments ca. 5-15 times as long as broad. Outer surface of calyx with spreading stellate hairs with (4)5-6(7) arms, each arm 0.05-0.3(0.8) mm long. Petals 3-5 mm long. Mericarps narrowly and partially separating from each other in mature fruit, with angles on dorsal surface narrowly winged.+ dentate or undulate .... *M. parviflora* L.

Representative and cited specimens

M. nicaeensis All.

SOUTH AUSTRALIA (29 specimens seen from Southern Lofty, Kangaroo Island and South-eastern regions): *Anon. s.n.,* 21.ix.1907, North Parklands, [Adelaide], AD 97612180 p.p. (Herb. Black: 'M. nicaeensis') — *Anon. s.n.,* 20.xii.1910 East Park [lands, Adelaide], AD97612180 p.p. (Herb. Black: 'M. nicaeensis'). – *Anon. s.n.,* 12.xi.1949, N. Parklands [Adelaide], AD97612181 (Herb. Black: 'M. nicaeensis'). —*Barker 1865-1867, 1871,* 26.xi.1976, Botanic Park, Adelaide, AD. — *Barker 1875,* 27.xi.1976, corner of Bayly St. and Davidson Ave., Hendon, Adelaide, AD. — *Barker 1876,* 29.xi.1976, Russian Orthodox Church grounds, Greenhill Road, Wayville, Adelaide, AD. — *Barker 1881,* 29.xi.1976, Mortlock Park Oval, Colonel Light Gardens, Adelaide, AD. — *Cleland s.n.,* 13.i.1957, 14.i.1957, Victor Harbour, AD97310072, AD97310074. — VICTORIA (only specimen): *E.F.F. s.n.,* s. dat., Melbourne, ADW1585.

EUROPE: *Smith s.n.,* ix.1925, Splott, Cardiff, Wales, ADW17683.

NORTH AMERICA: *McCarthy 20,* 5.v.1953, Davis High School, Davis, California, ADW.

M. parviflora L.

SOUTH AUSTRALIA (ca. 120 specimens seen, from all regions excluding North-western and Gairdner-Torrens Basin): *Alcock 3731,* 21.ix.1971, Oraparinna National Park, Flinders Ranges, AD. — *Anon s.n.,* 3.xi.1906, Norwood (Osmond Terrace) [Adelaide], AD97612177 p.p. (Herb. Black: 'M. verticillata'). – *Anon. s.n.,* 3.x.1916, Hawker, AD97612178 p.p. (Herb. Black: 'M. parviflora'). – *Anon. s.n.,* 21.ix.1948, reserve

between Kintore Ave & parade ground, [Adelaide], AD97612234 p.p. (Herb. Black: 'M. verticillata'). — *Anon. s.n.,* 12.ii.1950, 5.iv.1950, garden, Brougham Place [Adelaide], AD97612179, AD97612177 p.p. (Herb. Black: 'M. parviflora'). — *Barker 1868-1870,* 26.xi.1976, Botanic Park, Adelaide, AD. — *Barker 1874,* 27.xi.1976, corner of Bayly St. and Davidson Ave., Hendon, Adelaide, AD. — *Barker 1877,* 29.xi.1976, Russian Orthodox Church grounds, Greenhill Road, Wayville, Adelaide, AD. — *Barker 1878-1880,* 29.xi.1976, Mortlock Park Oval, Colonel Light Gardens, Adelaide, AD. — *Barker 1883,* 28.xii.1976, G.T. Short's property, Mickey Flat Road, between Port Julia and Curramulka, ca. 3½km west of main Ardrossan-Port Vincent road, AD. — *Blaylock 922,* 21.viii.1968, Nectar Brook, AD. *Cleland s.n.,* 14.i.1957, Victor Harbour, AD97310071. — *Cleland s.n.,* 9.i.1961, Victor Harbour, AD96122031, AD96122032. — *Cleland s.n.,* 16.i.1957, 25.i.1965, Encounter Bay, AD97310073, AD966031265. — *Copley 4485,* 30.viii.1974, Innes National Park, Inneston, AD. — NORTHERN TERRITORY (4 specimens): *Cleland s.n.,* 16.viii.1956, Haast's Bluff Reserve, AD97213023. — *Cleland s.n.,* 15.viii.1957, Alice Springs, AD97313119. — *Nelson 1984,* 19.xii.1969, A.I.B. farm, 6 m. S. Alice Springs, AD. — *Swinbourne 454,* 19.ix.1962, east side, Alice Springs, AD. — QUEENSLAND (only specimen): *Kennedy s.n.,* 10.xi.1935, Elderslie, Winton, ADW3554.

EUROPE: *Smith s.n.,* viii.1925, Newport, Isle of Wight, England, ADW17682.

M. pusilla Sm.

EUROPE: *Aellen s.n.,* 21.ix.1934, Basel und Umgebung, Elsass, unterhalb St. Louis, AD97703529, — *Aniol s.n.,* 5.viii.1969, Silesia Inferior, Lubin Stary, ad viam "Oborowa", AD97211276. — *Anon s.n.,* s.dat., without locality, AD97703536, AD97703538.

M. verticillata L.

SOUTH AUSTRALIA (1 specimen, South-eastern region): *Williams per Barker 1884,* i.1977, Kybybolite Agricultural Research Centre, cultivated from German seed, AD.

EUROPE: *Guzikowie s.n.,* 11.ix.1966, Poland, Orawa divisions: Lipnica Wielka/Nowy Tary district, AD97050055.

LAVATERA L.

While the widespread and rather variable native species *L. plebeia* Sims and the introduced European species *L. arborea* L. have been consistently regarded as occurring in the South Australian flora, the existence of a further European introduction *L. cretica* L. has been open to question (Eichler, 1965).

L. cretica has been reported in eastern Australia from waste ground in the region of Melbourne (Willis, 1973) and Sydney (Beadle, Evans & Carolin, 1972). Black (1909, 1926) initially recorded the species as a naturalized member of the South Australia flora, presumably on the basis of several collections (mounted on the single sheet *AD97612130* in the Black Herbarium) made early this century from the suburbs of Adelaide from "waste ground", "beside a path" and "under a fence". In addition, a collection *Cleland AD966031405* made in 1941 from Port MacDonnell was determined by Black as questionably belonging to the species. Despite these collections Black (1952) subsequently removed the species from the state's flora without explanation. Since that time two collections, previously misidentified as *L. plebeia* (which strongly resembles *L. cretica*), one from a vacant allotment in North Adelaide (*Sims AD96945079*), the other from a cleared roadside area by the Happy Valley Cemetery near Port Lincoln (*Alcock C31*), have been made. Mr J. Carrick (*Carrick 4020;* pers. comm. x.1976) confirms that the Port Lincoln population, first collected in 1964, flourishes today with about 30 plants, some reaching over 2 m high. It is clear that *L. cretica* is a naturalized member of the South Australian flora.

L. assurgentiflora is a native of islands offshore of California. It is naturalized in the mainland areas of that state (Wiggins, 1951; Munz & Keck, 1959), and noted in horticultural texts (e.g. Sprague, 1936; Bailey, 1949). Allan (1940) has reported its naturalization in New Zealand. The species is very distinctive by its long pedicels, spreading for the most part but distally abruptly erect, its large calyx, and its large mericarps.

Eichler's (1966) record of *L. assurgentiflora* for South Australia seems based on only a single herbarium specimen (*Anon. AD96207186*) from Meningie in the Upper South-East. The presence of the species in grey sand in gardens and yards about out-buildings in Meningie and nearby on The Coorong is now confirmed (*Barker 1897-1899*). The plants develop into densely foliose shrubs or small trees to 3m high, with robust herbaceous boles reaching 20(30)cm diameter.

Mr. J.F. Gibbs of Noonameena (pers.comm. 15.vii.1977) gave the following information. The species occurs around shacks, houses, water tanks or other similar sites along the length of The Coorong; a southern location is confirmed by Mr. B.E. Talbot-Smith, a weeds' officer at Kingston (pers. comm. 17.vii.1977), who has noted several large old trees at Chinaman Wells, about 60 km north of Kingston. Plants are used as windbreaks, but are palatable to stock and rabbits, and branches are often stripped of leaves. They are also maintained as ornamentals. While the plants at most if not all sites have probably originated from separate plantings, they produce copious seedlings which form a dense ground cover near the parents unless this is controlled by mowing. Despite this, and although the species has apparently existed in the region since before the 1930s, it has not spread away from the surrounds of the sites of its apparent plantings.

Whether *L. assurgentiflora* is considered naturalized in South Australia is open to question in view of its apparent lack of wider spread. It seems that the species once planted at a given site can maintain itself over many years, but has apparently not colonized new sites.

Key to the indigenous and naturalized species of Lavatera *in South Australia*

1a. Epicalyx segments exceeding the calyx, enlarging after anthesis. [*Leaves shallowly and broadly crenate. Indumentum stellate-villous, on the calyx 0.6-1.0(1.2) mm long. Pedicel (0.5)1-2(2.5) cm long, spreading but distally not abruptly erect. Calyx ca. 5 mm long, hardly enlarging after anthesis. Mericarps 6-7(8), 2.5-3.5(4) mm high; upper surface flattish, transversely wrinkled, with margins sharp or slightly winged, entire*] .... *L. arborea L.*

1b. Epicalyx segments shorter than the calyx, not enlarged after anthesis.

2a. Calyx tubular-campanulate, 10-18 mm long. Pedicels 2-6 cm long, spreading for most part, distally abruptly erect. Mericarps 5-7 mm high. [*Leaves coarsely dentate. Indumentum stellate-pubescent, ca. 0.1-0.3 mm long. Calyx strongly enlarging after anthesis, the tube incurved over fruit, the lobes spreading outwards, Mericarps ca. (?6)7-9; upper surface flat to roundish, smooth, with margins sharpish, entire*] .... *L. assurgentiflora Kell.*

2b. Calyx broadly campanulate, 5-9(10) mm long. Pedicels 0.5-2.5(5) cm long, spreading and sometimes (especially in *L. plebeia*) distally ascending. Mericarps 2-3.5 mm high.

3a. Indumentum stellate-pubescent, on calyx 0.1-0.3(0.5) mm long. Calyx strongly enlarging after anthesis, the tube exceeding and strongly incurved above the fruit, the lobes spreading outwards. Mericarps (9)10-14(16); upper surface usually concave or flat, rarely slightly convex, smooth or wrinkled towards margins, with margins very sharp or slightly winged, entire or crenate or dentate. [*Leaves crenulate or serrulate to serrate or dentate*] .... *L. plebeia Sims.*

3b. Indumentum stellate-velutinous, on calyx 0.5-1.0(1.5)mm long. Calyx tube enlarging after anthesis but not exceeding the fruit, the lobes incurved, appressed on the fruit. Mericarps (?7)8-10(?11); upper surface rounded, smooth or with scattered transverse wrinkles, with margins rounded to sharp, crenulate. [*Leaves serrate to crenate-serrate.*] .... *L. cretica L.*

Representative and cited specimens

L. arborea L.

SOUTH AUSTRALIA (32 specimens, from Eyre Peninsula, Northern Lofty, Murray, Yorke Peninsula, Southern Lofty, Kangaroo Island and South-eastern regions).

EUROPE: *Adams 195*, 26.vi.1945, Pixies Cove, Cornwall, England, ADW. — *Baenitz s.n.*, 10.v.1903, Istriaca, Lussinpiccolo, AD97703520. — *Bertrand s.n.*, 15.v.1900, Gallica, Var, Roquebrune, AD97703519.

L. assurgentiflora Kell.

SOUTH AUSTRALIA (4 specimens, South-eastern region): *Anon. s.n.*, s.dat., Meningie, AD96207186. — *Barker 1897,* 15.vii.1977, garden of Mr. D. Brumby, Edward St., Meningie, AD (sterile). — *Barker 1898,* 15.vii.1977, The Coorong, ca. 10 km SSE of Meningie, ca 1-2 km SE of Noonameena Camp, garden of Thompson's house, AD. — *Barker 1899,* 15.vii.1977, The Coorong, ca. 10 km SSE of Meningie, Noonameena, surrounds of J.F. Gibb's house, AD.

NORTH AMERICA: *Rose 34015,* 3.ii.1934, California, Lake Merced, AD. — *Schallert 22907,* 27.xi.1957, Carmel, Monterey, California, AD.

L. cretica L.

SOUTH AUSTRALIA (6 specimens, from Eyre Peninsula, Southern Lofty and South-eastern regions): *Alcock C31,* 2.xi.1964, Happy Valley near [Port] Lincoln Cemetery, AD. — *Anon. s.n.* 14.x.1907, Harvey's Garden, Kensington Road, Norwood [Adelaide], AD97612130 p.p. (Herb. Black: 'L. cretica'). — *Anon s.n.*, 6.xi.1924, between Brougham Place & Ward St. N. Adel[aide], AD97612130 p.p. (Herb. Black: 'L. cretica'). — *Carrick 4020,* 22.x.1976, Happy Valley Cemetery Port Lincoln, AD. — *Cleland s.n.,* 2.xi.1941, Pt. MacDonnell, AD966031405. — *Sims s.n.,* 21.xi.1964, vacant allotment, N. Adelaide, AD96945079. — NEW SOUTH WALES (only specimen): *Rodd 3001,* 16.xi.1975, Drummoyne, AD. — VICTORIA (only specimen): *Symon 126,* 8.xi.1959, Pt. Fairy, ADW.

NEW ZEALAND: *Bangerter 5275,* 14.xi.1975, North Island, Waitemata County, Browns Bay, Glen Road, AD.

L. plebeia Sims

SOUTH AUSTRALIA (210 specimens, from all regions). — NEW SOUTH WALES (6 specimens). — NORTHERN TERRITORY (5 specimens). — QUEENSLAND (1 specimen).

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Index to Scientific Names

Names

Synonyms, misapplied, misspelt or illegitimate names are in italics.

Page numbers

Page numbers in bold refer to the main taxonomic treatment.

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J. Adelaide Bot. Gard. 1(2): 115-122 (1977)

STUDIES IN AUSTRALIAN LAMIACEAE
2. *EICHLERAGO,* A NEW GENUS ALLIED TO *PROSTANTHERA*

J. Carrick

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Abstract

Eichlerago, a new genus from Western Australia, is characterized. The single species, *E. tysoniana*, known from only two collections, is described and figured. *Eichlerago* possesses characteristics of both Lamiaceae and Verbenaceae (s. lat.), and an outline of the history of classification in both families is followed by a discussion of the relationships of the new genus, which is placed tentatively in Lamiaceae-Prostantheroideae.

Eichlerago Carrick, gen. nov.

Calyx bilabiatus, labio infero *sursum plicato fructum includenti;* corolla *bilabiata*, labio supero bilobo, lobis aequalibus, labio infero trilobo, *lobis aequalibus;* stamina quatuor, didynama, *fertilia, antheris bilocularibus, connectivo appendiculato; nectarium disciforme praesens;* ovarium tetraloculare, ovulo unico axillari basin versus in quoque loculo, stylo *terminali;* fructus siccus, ut videtur *indehiscens*, seminibus *albuminatis.*

Species typica: E. tysoniana Carrick, sp. nov.

Etymologia: honori Hj. Eichleri, per plures annos custodis Herbarii Australiae Meridionalis, doctoris fautorisque ardentis investigationum taxonomicarum hoc genus dicavi; atque ἄγω sensu duco adhortorque suffixi.

Calyx two-lipped, the lower lip folding upwards and enclosing the fruit; corolla two-lipped, the upper lip two-lobed, the lobes equal, the lower lip three-lobed, the lobes equal; stamens four, didynamous, fertile, anthers bilocular, connective appendaged; nectariferous disc present; ovary four-locular, one axile ovule attached towards the base of each loculus, style terminal; fruit dry, apparently indehiscent, seeds albuminous.

E. tysoniana Carrick, sp. nov.

["Prostanthera Tysoni F.v.M.", Muell. herb., nom. nud.; "P. Tysoni F.v.M." in Gardner, C. A., Enum. Pl. Austral. Occ. (1931)114, nomen; "P. sp." ("P. tysonii" in a bracketed note indicating illegitimacy) in Blackall, W. E. & Grieve, B. J., West. Austral. Wildfl. 3(1965)593, nomen; "P. tysonii F. Muell." in Beard, J. S., West Austral. Pl. ed. 2(1970)116, nomen.]

Typus: Isaac Tyson 25, "Mt. Narryer, Murchison River, 1898," (PERTH), holotypus hic designatus; (K) isotypi (2 specimens).

Frutex lignosus, ut 1 m altus aut ultra videtur, intricatus, divaricate ramosus, ferrugineus, ramulis lanatis, pilis implexis brunneolis dense vestitis. *Folia* decussata, brevissime petiolata, late elliptica vel suborbicularia vel transverse elliptica, rare ovata, 2-4 mm longa lataque, basi plus minusve truncata, margine integra vel interdum sinuata, plana vel interdum undulata; juvenilia lanata, adulta sparse villosescentia, utrinque glandulis circularibus sparsis tecta. *Flores* solitarii, axillares, pedicellis villosis, circa 1 mm longis, bracteolis villosis, lineari-lanceolatis, circa 1 mm longis. *Calyx* tubo obconico, circa 3 mm longo, costato, extus sparse villoso, intus glabro; labio supero depresse ovato, concavo, obscure vel evidenter trilobo, lobis plus minusve aequalibus, utrinque sparse villosis et glandulis circularibus sparse tectis, circa 3 mm longo et 5 mm lato, fructifero recurvo atque accrescenti, circa 5 mm longo et 8 mm lato; labio infero late orbiculari, integro aut retuso vel emarginato, extus et margine intus villoso et glandulis circularibus sparse tecto, circa 3 mm longo et 4 mm lato, fructifero accrescenti, circa 3.5 mm longo et 6 mm lato. *Corolla* tubo obconico, circa 5 mm longo, utrinque glabro, purpureo-striato; labio supero recto, circa 6 mm longo latoque, profunde bilobo, lobis oblongis, late obtusis, utrinque villosis; labio infero profunde trilobo, lobis patulis, circa 5 mm longis et 3 mm latis, obtusis, utrinque villosis. *Stamina* filamentis ligulatis, tubi basin versus affixis, superis circa 3.5 mm longis, inferis circa 4.5 mm longis; antheris circa 1 mm longis, loculis subparallelis, connectivi calcare longiore loculum bis superante, apice cristato, breviore loculo aequilongo, adnato, cristato. *Fructus* sphaericus, circa 3 mm diametro, stylo persistenti.

Shrub, intricate, divaricately branched, reddish brown, woody, probably 1 m high or more, branchlets densely clothed in pale brown matted hairs. *Leaves* decussate, very shortly petiolate, broadly elliptic to almost circular to transversely elliptic, seldom ovate, 2-4 mm long and broad, more or less truncate at the base, the margin entire or sometimes slightly sinuate, flat or sometimes undulate; woolly when young, becoming sparsely villous, both surfaces with scattered small circular glands. *Flowers* solitary, axillary, pedicels villous, about 1 mm long, bracteoles villous, linear-lanceolate, about 1 mm long. *Calyx* tube obconic, about 3 mm long, ribbed, sparsely villous outside, glabrous inside; upper lip depressed ovate, concave, obscurely or obviously 3-lobed, the lobes more or less equal, sparsely villous and with circular glands on both sides, about 3 mm long and 5 mm broad, recurved in fruit and enlarging to about 5 mm long and 8 mm broad; lower lip broadly orbicular, entire or retuse or emarginate, villous and with circular glands outside and near the margin inside, about 3 mm long and 4 mm broad, enlarging in fruit to about 3.5 mm long and 6 mm broad. *Corolla* tube obconic, about 5 mm long, glabrous outside and in, streaked with purple; upper lip erect, about 6 mm long and broad, deeply 2-lobed, the lobes oblong, broadly obtuse, villous on both sides; lower lip deeply 3-lobed, the lobes spreading and each about 5 mm long and 3 mm broad, obtuse, villous on both sides. *Stamens* with strap-shaped filaments attached near the base of the tube, the upper about 3.5 mm long, the lower about 4.5 mm long; anthers about 1 mm long, the locules almost parallel, the longer appendage of the connective as long again as the cell, the apex cristate, the shorter appendage about as long as the cell, adnate, cristate. *Fruit* spherical, about 3 mm diameter, style persistent. (Fig. 1).

There are two collections, both of which were made by Isaac Tyson. The first, MEL 41916, is annotated in Mueller's hand: "Prostanthera Tysoni F.v.M. Upper Murchison R. 1892. Isaac Tyson" and, on a separate label: "No 4." The PERTH portion of the second collection is annotated in an unknown hand: "Prostanthera Tysoni Mt. Narryer, Murchison River. Isaac Tyson 25 (1898)". The name was never legitimized but was mentioned by Gardner (1931), Blackall & Grieve (1965) and Beard (1970). Both collections have fragments in envelopes and are adequate for identification. Although the later collection was not seen by Mueller who died in 1896, it is identical with his "Prostanthera Tysoni", and as it is the better of the two, and now contains mounted dissections of the flower, it is designated as the holotype (PERTH). The two isotypes (K) are mounted on one sheet, one obtained through the "Herb. A. Morrison", the other presumably received direct from C. A. Gardner.

Attempts have been made to obtain specimens from the Mt. Narryer area of Western Australia. In 1975, heavy local rains caused severe flooding and the track from Mt. Narryer Homestead was impassable. A search in the neighbourhood of the Homestead was unsuccessful. In 1976, there had been widespread lack of rainfall resulting in poor growth and flowering, and collectors passing through the area did not consider it worth while to visit the mount.

Taxonomic position

Taxonomic studies in the Lamiaceae (Labiatae, nom. alt.) and the Verbenaceae (s. lat.) at the State Herbarium of South Australia were begun under the direction of Dr. Hj. Eichler, now Curator, Herbarium Australiense, C.S.I.R.O., Canberra, and he comments (pers. comm., 1976): "*P. tysonii* F. Muell., ined., seems to be exceedingly interesting, and I think may just represent the link between Prostantheroideae and Chloanthaceae I was hoping could be found to show the close relationship between the groups you and Munir are working on." [See Munir (1976)].

During the past almost three hundred years, systematists have experienced difficulties in arranging the numerous species in both families into appropriate taxonomic units, in the case of the Lamiaceae because of its homogeneity, and in the case of the Verbenaceae (s. lat.) because of its diversity. The following notes on the history of

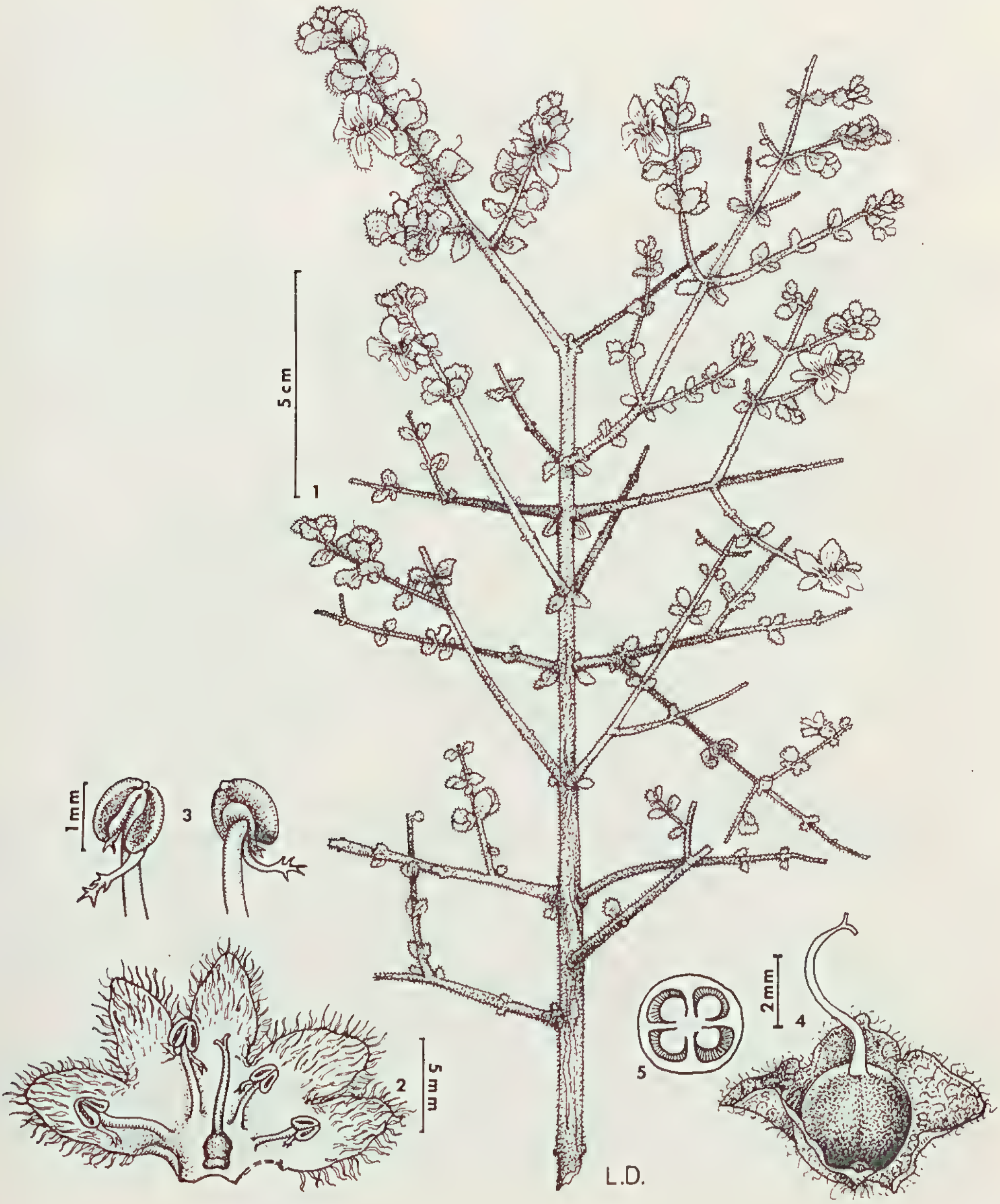

Fig. 1. *Eichlerago tysoniana* Carrick. Based on the Isaac Tyson 25 collection from Mt. Narryer, Murchison River, Western Australia, in 1898.
1, habit; 2, corolla opened out to reveal stamens and ovary; 3, front and back view of anther; 4, calyx upper lip with mature fruit (lower lip removed); 5, diagrammatic transverse section of fruit near base.

classification within these families assist in the placement of the new genus, albeit with some reservation.

Lamiaceae

Linnaeus (1751) adopted the name Verticillatae, which had been used previously by Ray (1682) for a group of genera now contained in Lamiaceae, and this was accepted by Rüling (1774), Scopoli (1777), Batsch (1802) and others. Tournefort (1694) used the name Labiati for a similar subdivision, B. de Jussieu (1759) amended the name to Labiatae and Lindley (1836) introduced the new alternative name Lamiaceae, which conforms with current usage. Both latter names are conserved.

Adanson (1763) first noted the uniformity of the group, a feature often later commented upon, particularly by A. L. de Jussieu (1789), Jaume St.-Hilaire (1805) and Bentham (1832-36). In consequence, throughout its history, the family has been subjected to various methods of classification based on different criteria. Adanson (1763) found characters of calyx, stamens, stigmas and pistil too little different, and those of corolla so varied even in species of the same genus, that he grouped his genera on the disposition of the flowers, the criteria being the presence or absence of bracts, whether these were similar to the stem leaves or not, and whether the flowers were distinct or several together on common peduncles. However, in his presentation of the genera in tabular form, he distinguished two-lipped and five-partite calyces and sterile stamens.

Scopoli (1777) based his primary division on whether all four stamens are fertile or only two, subdivision being made on the presence of a labiate or non-labiate calyx. Jussieu (1789) used the same criteria with, in addition, features of the corolla, so that *Ajuga* and *Teucrium* were segregated from the rest because the corolla appears "unilabiate". Jaume St.-Hilaire (1805) followed Jussieu closely and commented: "The genera are all the more artificial as the families of which they are part are the more natural." (transl.). Brown (1810) and Bartling (1830) also used characters of calyx and stamens but not corolla, resulting in separation of the Australian genera described by Smith (1797), Labillardière (1806) and Brown (1810), the present Prostantheroideae, into two parts.

Bentham, in his revision of the family (1832-36), and in his review for de Candolle's 'Prodromus' (1848), and Walpers (1844-45), had difficulty in arranging the species into genera and tribes. Bentham's exhaustive discussion of the vegetative and reproductive parts of the plants reveals the difficulties encountered in ordering the many genera and species. "The order of the Labiatae is one of the most natural and distinctly marked of all. The opposite leaves, monopetalous corolla, 2 or 4 stamina and the free 4-lobed ovarium are characters so easily observed, and so constantly accompanying the general habit of the whole series, that, from the time of Linnaeus to the present day, but two or three genera have been improperly associated with, or separated from, it." (1835). "The genera have very close affinities amongst themselves, and are with difficulty delimited, and the numerous species amongst themselves are exceedingly similar or extremely variable, it is often with great doubt that they are joined together or separated." (1848), (transl.). Bentham placed considerable weight on the features of the stamens associated with those of calyx and corolla for the diagnosis of the tribes. His arrangement was followed by Endlicher (1838) and is well shown by Meisner (1840) who presented the data in the form of an indented dichotomous key.

With Bentham & Hooker (1876), some change in emphasis occurred, and characters of the gynoecium were used to determine the major subdivisions of the family. Lindley (1836) had already commented: "The 4-lobed ovary, with a solitary style arising from the base of the lobes, has no parallel among monopetalous orders except Nolanaceae, which have a plaited corolla, and Boraginaceae, to which Labiatae must be considered as most closely allied." In Bentham & Hooker (1876), Briquet (1895-97) and Melchior (1964), the depth of separation and the attachment of the nutlets differentiated the groups of

subfamilies, and the Ajugoideae and Prostantheroideae became segregated from the others. In these, Briquet considered that the style was not gynobasic, and Melchior that it was terminal or sunken. Bentham (1832-36), Lawrence (1955) and Hutchinson (1973) considered the style gynobasic. Cronquist (1968), in his key to the Lamiales, used as one of the distinguishing features of the Lamiaceae "style mostly gynobasic" as opposed to "style terminal" for Verbenaceae (s. lat.).

In distinguishing the genera of Prostantheroideae, as at present recognized, Bentham (1848, 1870), Briquet (1895-97) and Carrick (1976) have placed considerable emphasis on the fertility of the stamens and the presence of staminal modifications or appendages.

Verbenaceae (s. lat.)

The Asperifoliae of Ray (1682) and the Personatae of Linnaeus (1751) comprised several families, for one of which Jaume St.-Hilaire (1805) introduced the name Verbenaceae, which is conserved. However, Reichenbach (1828) placed the family in Verbeneae as a section of Labiatae, and Junell (1934), on the basis of anatomical studies of the gynoecium, placed a large part of the Verbenaceae (s. lat.) in the Labiatae, notably Chloanthoideae close to *Ajuga,* a rearrangement which has not since been supported.

From the outset, the emphasis for classification of the Verbenaceae (s. lat.) has been placed on the fruit. Jussieu (1806) commented: "This last character [fruit] varies in a number of ways which combine to designate the genera. Thus, sometimes it is a stone-fruit [noyau] with four single-seeded cells occupying the centre of a more or less fleshy berry; sometimes it contains two stone-fruits each with two cells, or four single-seeded stone-fruits. Sometimes the seeds exist in the fruit without a bony envelope; sometimes the almost dry fruit takes the form of a capsule which does not open: or, reduced to a simple reticulate tissue around the seeds and serving to unite them prior to maturity, it disappears while the seeds are enclosed, and leaves them almost naked as in the Labiatae. This last character is most remarkable in the Verbenas, which thus establish a transition from one family to the other." (transl.).

Lindley (1836) viewed the Verbenaceae (s. lat.) thus: "The difference between these plants and Labiatae consists in the concrete carpels of the former, their terminal style, and the usual absence of reservoirs of oil from their leaves, as contrasted with the deeply 4-lobed ovary and aromatic leaves of the latter." Bentham & Hooker (1876), Briquet (1895-97) and Melchior (1964), utilised the inflorescence and features of flower and fruit in various ways to group genera into subfamilies and tribes.

As was to be expected, some of these have been separated and raised to family rank: Stilbaceae by Kunth (1831), Avicenniaceae by Endlicher (1841), Phrym[at]aceae by Schauer (1847), Dicrastylidaceae by Drummond & Harvey (1855) nom. illeg., Nyctanthaceae, Durantaceae and Petraeaceae by Agardh (1855), Symphorem[at]aceae by van Tieghem (1891), Chloanthaceae by Hutchinson (1959). Some of these families are not recognized by some authors; most remain in Verbenaceae (s. lat.) with subfamily rank. The basis of subdivision, as shown in Briquet (1895-97) and Melchior (1964), is mainly on number of locules and their separation at maturity, type and placentation of ovules, presence of albumen.

Discussion

From the outline history of the classification of the Lamiaceae, it is clear that the bilabiate calyx and unique stamens of *Eichlerago* place it in close relation to *Prostanthera* in the Prostantheroideae. *Eichlerago* is similar to *Prostanthera* in having: simple, decussate leaves; simple hairs; surface glands; bracteoles; a two-lipped calyx enclosing the fruit; four fertile didynamous stamens; anther cells muticous and not confluent; an appendaged connective; a basal disc; axile/basal placentation; albuminous seeds. *Eichlerago* differs in having: lower corolla lip with three equal lobes; a dry, indehiscent

fruit; a terminal style. Note that, of the ninety or so species of *Prostanthera:* only one has branched hairs; many have anther cells which are not muticous; many have connectives which are not appendaged; albumen is usually meagre. The stamens of *Eichlerago tysoniana* are almost identical with those of *Prostanthera lasianthos* Labill. The bilabiate calyx with three more or less distinct lobes on the upper lip and/or two lobes on the lower, are features also found in a number of species of *Prostanthera.*

From a consideration of the development of classification in the Verbenaceae (s. lat.), the entire, four-locular, indehiscent ovary, the terminal style and the presence of endosperm relate *Eichlerago* to the Chloanthaceae (or Chloanthoideae of the Verbenaceae). *Eichlerago* is similar to Chloanthaceae in having: simple decussate leaves; surface glands; bracteoles; persistent calyx; two-lipped corolla; four fertile didynamous stamens; anther cells muticous and not confluent; a basal disc; a four-celled ovary; a terminal style; a dry, indehiscent fruit; albuminous seeds. *Eichlerago* differs in having: simple hairs; a two-lipped calyx enclosing the fruit; lower corolla lip with three equal lobes; appendages on the connective; axile/basal placentation. Note that, in Chloanthaceae: the corolla is two-lipped in Chloantheae only, not so in Physopsideae; anther cells are confluent in *Spartothamnella* only; the fruit is a succulent drupe in *Spartothamnella* only; the ovary is four-celled and placentation axile/apical, contrary to Hutchinson (1973). There are no instances in the Verbenaceae (s. lat.) of stamens with connective appendages as found in *Prostanthera* and *Eichlerago.* [Munir (1976, and verb. comm.)].

The data are shown in Table 1. Many characters are common to *Prostanthera, Eichlerago* and Chloanthaceae, completely so or only partially. Those which distinguish *Eichlerago* and *Prostanthera* from Chloanthaceae are features of the gynoecium, placing *Eichlerago,* on the data at present available, between Prostantheroideae and Chloanthaceae.

While the gynoecium of Lamiaceae affords but little variation for use as a taxonomic criterion, that of Verbenaceae (s. lat.) provides the primary basis for subdivision. Affinities between the two families are close, many characters being common, even to a superficial similarity in the ovaries. The ovary of Lamiaceae develops as four separate nutlets. In Prostantheroideae and Ajugoideae the ovary is much less lobed than in most other subfamilies of Lamiaceae. The attachment of the nutlets in Lamiaceae is sometimes very oblique or almost lateral, yet I have observed in *Prostanthera* that the receptacle extends upwards between the nutlets, and the point of attachment of the style is at the apex of the receptacle, a condition which, at least, can be considered not terminal. In *Verbena* and Chloanthaceae the ovary is initially slightly lobed, but there is always present an axis between the receptacle and the base of the style, which is always terminal. In *Verbena* and *Spartothamnella,* the ovary always develops as a unit and separates into four fruitlets after it has matured.

Remarking on the relationships between the two families, Bentham (1832-36) wrote: "Amongst the genera in other respects intermediate, *Chloanthes* has been instanced by Mr. Brown as having the habit of Labiatae with the characters of Verbenaceae; and *Hoslundia,* on the contrary, as being Verbenaceous with Labiate characters; to these instances may be added the close resemblance *in all but fruit* [italics mine] between *Teucrium betonica,* etc. and *Vitex ovata,* etc." Also indicative of close family ties is Bentham & Hooker's (1876) action in referring "*Oxera* Labill., sometimes previously included in Labiatae, to Verbenaceae because of the drupaceous fruit." (transl.).

While it is recognized that the inclusion of a genus in a family, or its rejection from it, on the basis of one or two characters, may be questionable, it is true that one constant character is of more value than several inconstant ones. Here, the constant characters of greatest importance are the gynobasic style and free nutlets of Lamiaceae, the two-lipped calyx enclosing the fruit and the appendaged connective of Prostantheroideae, and the terminal style and dry, indehiscent fruit of Chloanthaceae.

The anomalous nature of *Eichlerago* is shown in its possession of a combination of these characters and places it between Prostantheroideae and Chloanthaceae. Because *E. tysoniana* does not fit readily into either, it is tempting to propose a new family to accommodate it, but although from the information available it is sufficiently distinct, further studies on pollen, chromosomes, anatomy, etc. are necessary before deciding its appropriate taxonomic position. The overall impression of the plant is prostantheroid, the aberrant feature being the fruit, while the bilabiate calyx and appendaged connective appear, in this case, to be more significant. *Eichlerago* is therefore tentatively placed in the Prostantheroideae, but, because of the fruit, in a tribe distinct from the other genera.

In order to accomodate *Wrixonia* and *Eichlerago*, the diagnoses for Prostantheroideae in Bentham (1832-36), Bentham & Hooker (1876), Briquet (1895-97) and Melchior (1964) should be modified in the following particulars: stamens 4, fertile, or only 2 (upper or lower pair sterile); style gynobasic, very rarely terminal; fruit of 4 separate nutlets, very rarely entire, dry and indehiscent.

The two tribes are then distinguished as follows:

Tribus 1. Prostanthereae Benth.

Calyx quinquelobus vel bilabiatus; corolla lobo medio labii inferi magniore; stamina 4 vel 2 fertilia, bilocularia vel abortu unilocularia, connectivo appendiculato vel diverse immutato; stylus gynobasicus; fructus ex 4 nuculis discretis consistens.

Genus typicum: *Prostanthera* Labill.

Tribus 2. Eichleragineae Carrick, trib. nov.

Calyx bilabiatus; corolla lobis labii inferi aequalibus; stamina 4 fertilia, bilocularia, connectivo appendiculato; stylus terminalis; fructus integer, siccus, indehiscens.

Genus typicum: *Eichlerago* Carrick.

Table 1. Comparison of *Eichlerago* with *Prostanthera* and Chloanthaceae.

(For greater ease of comparison, the data are presented so that in each case *Eichlerago* has a + sign.)
(+ = present; - = absent; ± = present in some species.)

Character	*Prostanthera*	*Eichlerago*	*Chloanthaceae*
Leaves simple, decussate	+	+	+
Hairs simple	±	+	–
Surface glands present	+	+	+
Bracteoles present	+	+	+
Calyx two-lipped	+	+	–
persistent	+	+	+
enclosing fruit	+	+	–
Corolla two-lipped	+	+	±
lower lip with three equal lobes	–	+	–
Stamens all fertile	+	+	+
didynamous	+	+	±
cells not confluent	+	+	±
cells muticous	±	+	±
connective appendaged	±	+	–
Basal disc present	+	+	+
Ovary four-celled	+	+	+
Style terminal	–	+	+
Fruit dry, indehiscent, entire	–	+	+
Placentation axile/basal	+	+	–
Seeds albuminous	±	+	+

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NOTES ON *EREMOPHILA* R.BR. (MYOPORACEAE) IN SOUTH AUSTRALIA

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Abstract

Three species of *Eremophila,* namely *E. clarkei* Oldfield & F. Muell., *E. obovata* L. S. Smith and *E. turtonii* F. Muell., are recorded in South Australia for the first time. A brief description, based on South Australian material, and a map showing the known distribution in the state, is provided for each species.

The occurrence in the state, of *E. denticulata* F. Muell. and *E. goodwinii* F. Muell., which were included in Black's "Flora of South Australia," (1957) is considered very doubtful.

New Records of *Eremophila* for South Australia

Specimens of three *Eremophila* spp., *E. clarkei, E. obovata* and *E. turtonii,* not previously recorded for South Australia, have recently been found during sorting and identification of collections held at the State Herbarium. The descriptions provided below are based on South Australian material.

Eremophila clarkei Oldfield & F. Muell., Fragm. 1: 208 (1859).

The South Australian material of *Eremophila clarkei* is very homogeneous and falls well within the concepts of the species, which is, however, very polymorphic and at present poorly understood. The South Australian form differs from the commonest Western Australian one, which has narrowly linear-lanceolate markedly dentate leaves, in having shorter broader leaves which are obscurely dentate or entire.

Eremophila clarkei is most likely to be confused with *E. gilesii* F. Muell. and *E. willsii* F. Muell., from which it differs in the presence of substellate to stellate hairs on the leaves and branches, hardly imbricate ovate to ovate-lanceolate calyx-segments which become enlarged and scarious after flowering and the sigmoid pedicel longer than the calyx-segments.

Description

Shrub 1-1.6 m high, with ascending branches; branches minutely stellate pubescent. *Leaves* alternate, narrow lanceolate to lanceolate, 2-2.5 cm long, 3-5 mm broad, obscurely dentate or entire, minutely sparsely stellate-pubescent. *Flowers* axillary, solitary; pedicel sigmoid 1-2 cm long, minutely stellate-pubescent. *Calyx* 5-partite; segments unequal ovate to ovate-lanceolate, purplish, becoming enlarged and scarious after anthesis, sparsely pubescent. *Corolla* blue to mauve, pubescent. *Stamens* included. *Ovary* densely hirsute, covered with short glandular and long, simple and branched hairs; style hirsute. *Drupe* broadly ovoid, about 8 mm long, 6 mm broad near the base.

Distribution in South Australia (see Fig. 1)

North Western Region: *Pastoral Board of South Australia s.n.,* 27.ix.1955, Mt. Hardy (AD 97629369); 27.ix.1955, Bryson Hill — Mt. Hardy (AD 97629357); 27.ix.1955, Bryson Hill (AD 97629356).
Nullarbor Region: *H. Turner s.n.,* 10.viii.1960, 1 km N. of RB1 area, Maralinga (AD 96220040); *H. Turner s.n.,* 1.ix.1960, 1 km E. of RB1 area, Maralinga (AD 96220044); *H. Turner s.n.,* 1960, Maralinga (AD 97605396); *P. Wilson 1774,* 18.ix.1960, near Maralinga (AD).

Eremophila obovata L. S. Smith, Proc. Roy. Soc. Qld. 87: 33 (1956) var. **obovata**

Eremophila obovata is known from a number of locations in the Lake Eyre Basin Region, especially in the vicinity of Cordillo Downs in the extreme north-east of the state bordering Queensland. There is one collection from Oodnadatta over 500 kilometres to the west of Cordillo Downs, and it is likely that the species occurs at least in areas intermediate between these two locations.

The densely tomentose, subplumose hairy stems and the leaf shape are sufficient to distinguish this species from others in South Australia.

Description

Shrub, much branched, to 50 cm high; branches white tomentose. *Leaves* alternate, broadly obovate to flabellate, 8-11 (13) mm long, 7-9 (11) mm broad, cuneate towards the base, shortly acuminate, margins often undulate, dentate near apex, sparsely subplumose above, moderately subplumose below. *Flowers* axillary, solitary; pedicel short, subplumose. *Calyx* 5-partite; segments lanceolate, subequal, valvate, subplumose especially along the margins, enlarging after anthesis. *Corolla* blue, 1-1.2 cm long, very sparsely pubescent outside. *Stamens* included. *Ovary* and style glabrous. *Drupe* subglobose, about 6 mm long.

Distribution in South Australia (See Fig. 1)

Lake Eyre Basin Region: *C. D. Boomsma s.n.*, 21.xi.1975, 75 km S. of Cordillo Downs, 27° 44'S, 140° 46'E (AD 97551074); *N. N. Donner 5332*, 28.viii.1975, 30 km E. of Cordillo Downs, 4 km W. of Arrabury Homestead, 26° 46'S 140° 59'E (AD); *J. L. Johnson & S. Reed s.n.* no date, Oodnadatta (AD 96004121); *Pastoral Board of South Australian s.n.*, 1.vi.1957, Innamincka (AD 97635013).

This species also occurs in the Northern Territory and southwest Queensland.

Eremophila turtonii F.Muell., Fragm. 10: 87 (1876)

In South Australia, *E. turtonii* is known only from Mt. Moulden in the extreme north-west of the state. Two of the collections are typical of the species and the description below is based on these collections. A third collection (AD 97630156) differs in a number of respects: the leaves are very sparsely stellate-pubescent above but glabrous below with slightly revolute margins; the stems are irregularly tomentose, the portion of stem below the leaf base being glabrous; the outside of the calyx-segments are glabrous except along the margins or for the occasional hair on the surface. Flowers have not been observed in this abberant form.

The stellate-tomentose stems, the ovate to obovate stellate-tomentose leaves and the large oblong non-imbricate calyx-segments distinguish *E. turtonii* from other South Australian species.

Description

Shrub to about 1m high; branches grey-white tomentose. *Leaves* alternate, obovate to oblanceolate, entire, 1.5-4 cm long 0.5-0.9 mm broad, stellate-tomentose on both surfaces, the pubescence of young growth including stem often yellow. *Flowers* axillary, solitary; pedicel short 5-7 mm long, stellate-tomentose. *Calyx* 5-partite; segments oblong, obtuse 1.5-2 cm long, 4-6 mm broad, stellate-tomentose inside, stellate-pubescent outside. *Corolla* creamy pink, 2-2.3 cm long, stellate-pubescent outside. *Stamens* and style exserted. *Ovary* and style glabrous. *Drupe* ovoid, glabrous, about 8 mm long, 4-5 mm broad.

Distribution in South Australia (see Fig. 1)

North-Western Region: *Pastoral Board of South Australia s.n.*, 25.ix.1955, Mt. Moulden (AD 97628552, 97630156, 97630164).

This species also occurs in the Northern Territory and Western Australia.

Species of *Eremophila* doubtfully recorded for South Australia

Eremophila denticulata F.Muell., Fragm. 1: 125 (1859).

Black (1957) recorded this species from "near Eucla" but no South Australian collections have been located. It is likely that Black accepted this species on the authority of Mueller (1887) who recorded the species as "near Eucla, Bate".

There is only one specimen at MEL under *Eremophila denticulata* or the very closely related *E. decipiens* Ostenf. which could be considered as the specimen referred to by Mueller (H. Aston, pers. comm.). This specimen is labelled "Eucla/1886 J. D. Batt" on a blue "Phytologic Museum of Melbourne" label with the identification (which appears to be in Mueller's handwriting) of "*Eremophila denticulata* F. Muell." A packet attached to the sheet, and containing a fruit is labelled "Eremophila denticulata/Eucla/1886 J. D. Batts," not in Mueller's handwriting. Mueller's article was read to the Royal Society of South Australia on September 6th 1886, so the date of collection is consistent with the date of reading. It is possible that the name "Batt" appeared in publication as "Bate" assuming that it was considered by Mueller to be a mispelling. Indeed the type collection of *Melaleuca quadrifaria* F.Muell., a species published in 1886 and which appeared in Mueller's paper of 1887, is labelled "J. D. Bate near Eucla." This was cited in the same way as *E. denticulata*. One could also suppose that "Eucla" appeared as "near Eucla" to be consistent with the other records cited in this manner.

The specimen at MEL is not consistent with *E. denticulata* and fits well *E. decipiens* Ostenf., a species not recognised at the time Mueller's paper was published. It seems likely that this species was mistaken for *E. denticulata*.

Even supposing that there does exist elsewhere a collection of *E. denticulata* collected by "J. D. Bate near Eucla" there seems little reason to consider that it was collected in South Australia. Such vague locations give no indication of distance or direction from a given place and in the nineteenth century it could well have been one or fifty miles from the site in any direction.

Since the only known collection labelled "E. denticulata" held at MEL collected at Eucla in 1886 by J. D. Batt is not this species but *E. decipiens* and in view of the vague location data the record by Mueller (1887) of *E. denticulata* for South Australia is rejected. The species is not considered to occur in this state.

Eremophila goodwinii F.Muell., Rep. Babb. Exped. 17 (1859).

No authentic material of this species from South Australia is held at AD. All collections from South Australia included under this species name have now been reidentified as *E. clarkei, E. gilesii* F.Muell. and *E. willsii* F.Muell.

If this species does occur in the state it may be expected to occur in the eastern Lake Eyre Basin Region where it is known to occur close to the border in the adjacent states and Northern Territory.

Acknowledgement

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Fig. 1. Distribution of *Eremophila clarkei, E. obovata* and *E. turtonii* in South Australia.

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A NATURALLY OCCURRING PUTATIVE INTERSPECIFIC HYBRID IN *EREMOPHILA* (MYOPORACEAE)

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Abstract

A naturally occurring putative hybrid between *Eremophila oppositifolia* R.Br. and *E. scoparia* (R.Br.) F.Muell. was found at Whyalla, South Australia.

The hybrid is morphologically intermediate in most characters between the two species and has a much increased pollen sterility. Illustrations, and a tabulated comparison, of the more important vegetative, floral and fruit features are provided for the hybrid and its parents.

Introduction

In June 1976, when assisting in the erection of a fence to enclose the newly established fauna park just west of Whyalla, one of the authors (P.H.) noted an *Eremophila* close to the western fenceline. The solitary plant was growing in association with *Eremophila scoparia* (R.Br.) F.Muell. and *E. oppositifolia* R.Br. var. *oppositifolia* in an open *Acacia sowdenii* woodland on red sandy clay loam. Other common shrubs included *Atriplex vesicaria* Hew. ex Benth. and *Maireana sedifolia* (F.Muell.) P. G. Wilson.

The plant could not be referred to either of the above species of *Eremophila* or to any of the others known to occur in the park, namely *E. alternifolia* R.Br., *E. glabra* (R.Br.) Ostenf. and *E. longifolia* (R.Br.) F.Muell. In fact it appeared to be an intermediate between *E. oppositifolia* and *E. scoparia.*

A more detailed analysis of the intermediate plant and of the probable parents was carried out at the State Herbarium. Quantitative and qualitative measurements, provided in Table 1, are based entirely upon the Whyalla populations and therefore do not necessarily represent the full ranges of variability of the two species. Pollen grains were stained in iron-acetocarmine.

Details of Collections

SOUTH AUSTRALIA, EYRE PENINSULA: Whyalla, western boundary of Fauna Park near Airport 33° 03'S, 137° 31'E

E. oppositifolia: R. J. Chinnock 2994, 21.viii.1976 (AD, PERTH); *P. Hudson s.n.,* 6.i.1977 (AD 97702121).
E. oppositifolia x *scoparia: R. J. Chinnock 2993,* 21.viii.1976 (AD, K, NSW, PERTH); *P. Hudson s.n.,* 6.i.1977 (AD 97702122).
E. scoparia: R. J. Chinnock 2995, 21.viii.1976 (AD, PERTH).

Discussion

The intermediate plant is considered an F_1 hybrid between *Eremophila oppositifolia* and *E. scoparia.*

The indumentum of the stem and leaves of the hybrid is interesting because of the two very different types found in the parents. The hairs of *E. oppositifolia* are flattened,

Table 1 Comparison of vegetative, floral and fruit features of *Eremophila oppositifolia*, *Eremophila scoparia* and their putative hybrid based upon the Whyalla populations.

	E. oppositifolia	putative hybrid	E. scoparia
STEM:			
indumentum	grey tomentose	grey scurfy tomentose	silvery-grey lepidote
shape in cross-section	terete	terete	tetragonous
surface features	smooth	tuberculate	tuberculate
internodes (cm)	(0.4) 0.7-0.9	(1.45) 1.5-2.0 (2.2)	(1.0) 1.3-1.7 (2.2)
LEAF:			
length (cm)	(4.3) 5.6-6.8 (7.4)	(2.8) 3.3-4.9 (5.4)	(1.5) 1.6-1.9 (2.1)
width (mm)	1.5-2.2	1.5-2.0	1.2-1.8
indumentum	grey tomentose	grey tomentose	silvery-grey lepidote
hairs/scales	appressed tongue-like segmented hairs	irregularly shaped scurfy hairs to scales	peltate irregularly margined scales
PEDICEL:			
shape	subterete, slightly compressed	subterete, slightly compressed	laterally compressed ± ribbed
CALYX:			
segment length (mm)	12.5-13.2	3.1-4.3	2-2.5
segment shape	obovate	narrow oblong	triangular
segment apex	broadly obtuse	acute	acute
segment post anthesis	enlarged and reticulated	not enlarged, herbaceous	not enlarged, herbaceous
COROLLA:			
length (cm)	2.6-2.8	1.8-2.3	1.2-1.5
colour	cream tinged reddish above	mauve	blue
indumentum on outside	absent	substellate-stellate hairs	peltate scales
hairs on lobe margins	simple	simple and stellate	stellate
hairs in tube	simple	simple and arachnoid	arachnoid
STAMENS:			
lateral filament curvature	absent	weakly developed	pronounced
anther backs	glabrous	glabrous or with an occasional arachnoid hair	arachnoid hairy
pollen sterility % (minimum sample 200)	6.0	49.36	2.6
OVARY:			
length (mm)	4.2	3.0	2.5
shape	ovoid-oblong	narrow ovoid	ovoid-conical
apex	obtuse	obtuse	acute
indumentum	finely pubescent	finely pubescent	lepidote
STYLE:			
indumentum	sparsely hirsute throughout	scattered simple and branched hairs in lower half	lepidote, substellate and simple hairs in lower part especially towards the base
DRUPE:			
length (mm)	5.5-6.6	4.1-5.7	3.2-4.6
width (mm)	2.2-3.0	2.1-2.9	2.3-3.2
shape	oblong slightly compressed	ovoid-oblong ± terete	ovoid-conical ± tetragonous due to 4 ribs
indumentum	densely pubescent	densely pubescent	lepidote

Fig. 1. A. *E. oppositifolia;* B. *E. oppositifolia x scoparia;* C. *E. scoparia;* 1. Portion of stem with leaves (x0.75). 2. Enlarged portion of stem (x 4). 3. Indumentum type on stem and leaves (x 120). 4. Side view of flower (x 2). 5. Corolla lobe to show indumentum type (x 7). 6. Upper stamen (x 4). 7. Gynoecium (x 2). 8. Drupe (x 3.5). Del. L. Dutkiewicz.

tongue-like and segmented (Fig. 1A_3) where those of *E. scoparia* are peltate scales with irregular margins (Fig. 1C_3). In both cases they are appressed and completely cover the surface. In the hybrid the indumentum ranges from tongue-like hairs to almost peltate scales (see Fig. 1B_3 and compare with 1A_3, 1C_3) with various intermediate forms. Unlike the parents the indumentum is not evenly appressed and this gives rise to a scurfy appearance. In addition it is more readily lost and the leaves become partially glabrous with age.

Floral features are intermediate with the exception of the indumentum on the outer surface of the corolla which is substellate to stellate pubescent unlike both parents. The margins of the lobes in *E. scoparia* are, however, substellate or stellate pubescent (Fig. 1C_5) which has probably contributed to the inheritance of this type of indumentum in the hybrid.

Fruits do develop in the hybrid but all but two of the 10 seen were barren. The seed is similar in shape and size to that found in both parents.

The two putative parents belong to different sections of *Eremophila; E. oppositifolia* to sect. *Eremophila* and *E. scoparia* to section *Pholidia* (R.Br.) F.Muell. In both cases they are the type species of their sections. Although *Pholidia* has been considered by most authors to be only a section of *Eremophila* it was originally described as a distinct genus by Robert Brown.
The two sections differ in a number of floral and vegetative features and the occurrence of a hybrid is, therefore of particular interest and may prove important for future consideration of the status of *Pholidia.*

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A PUTATIVE HYBRID BETWEEN *CALADENIA DILATATA* VAR. *CONCINNA* AND *C. PATERSONII* VAR. *PATERSONII* (ORCHIDACEAE)

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Abstract

A naturally occurring putative hybrid between *Caladenia dilatata* R. Br. var. *concinna* H. M. Rupp and *C. patersonii* R. Br. var *patersonii* (Orchidaceae) is reported from Port Vincent, Yorke Peninsula, South Australia. The parents and putative hybrid are illustrated and their differences tabulated.

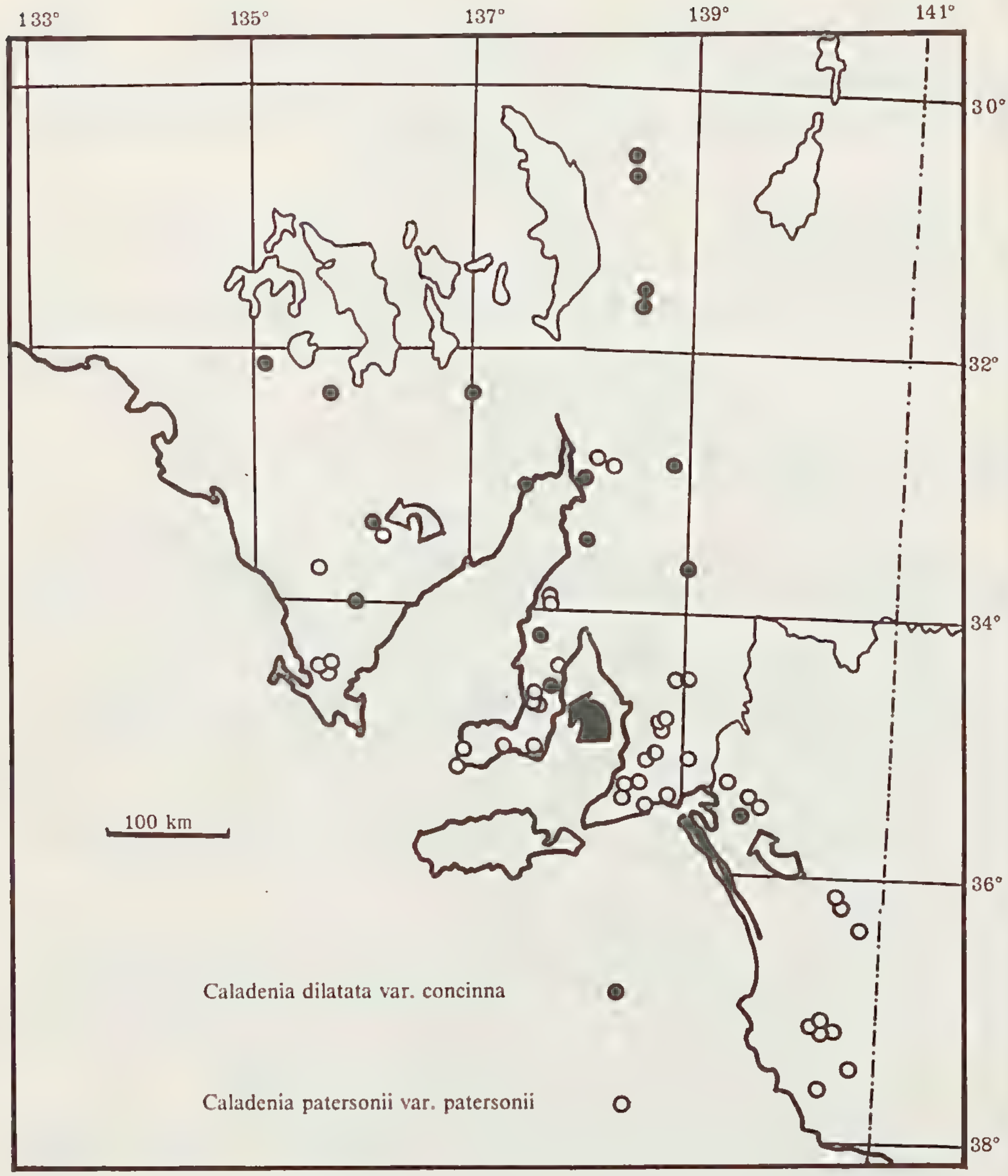
An apparent hybrid between *Caladenia dilatata* R.Br. (1810) var. *concinna* H. M. Rupp (1929) (syn. *C. toxochila* Tate, 1889) and *C. patersonii* R.Br. (1810) var. *patersonii* was collected, together with its putative parents, by R. Bates at Port Vincent (South Australia) on 28 August, 1976. He has also seen what he believes to be similar hybrids elsewhere in South Australia (Eyre Peninsula and east of Lake Alexandrina). See Map 1.

At Port Vincent both the putative parents are extremely common throughout an area of bush some 50-100 hectares in extent, and the apparent hybrid is also quite plentiful (probably in excess of 100 plants). It is possible that back-crossing has occurred but further field-work is needed.

Observations in the field suggest that hybrids do not occur in places where larger-flowered plants of *C. patersonii* grow with *C. dilatata* var. *concinna.* Large-flowered forms of *C. patersonii* occur in isolated populations over much of the range of the species in South Australia and have been found growing with *C. dilatata* var. *concinna* in northern Yorke Peninsula and south-east of Port Augusta. It has been observed that the same insects (Muscidae) visit flowers of widely differing sizes, but only come into contact with and remove the pollinia of flowers within a limited size-range.

Hybrids between the same pair of species have been recorded in Victoria by Willis (1962) and by Jones and Muir (1969), but in neither publication was it indicated to which varieties the putative parents belonged.

Table 1 indicates some of the more important differences, particularly in colour and size, between the specimens collected of the parents in the Port Vincent area and shows the extent to which the hybrid has intermediacy between the parents. The sample from which these measurements were taken is small, consisting only of specimens selected from the Port Vincent populations, and a few plants would deviate slightly from the ranges indicated. Other significant features, which are illustrated in Fig. 1, are the development of a caudiform appendage on the perianth segments, the shape of the calli on the labellum and the shape of the outline and of the margin of the labellum. The parts illustrated are typical of the species and the hybrid at Port Vincent, except that the labellum of *C. dilatata* var. *concinna* is not usually so deeply lobed.



Map 1. Distribution of *C. dilatata* var. *concinna* and *C. patersonii* var. *patersonii*. The black arrow indicates the source of the material illustrated. White arrows indicate other localities where similar hybrids are considered to occur.

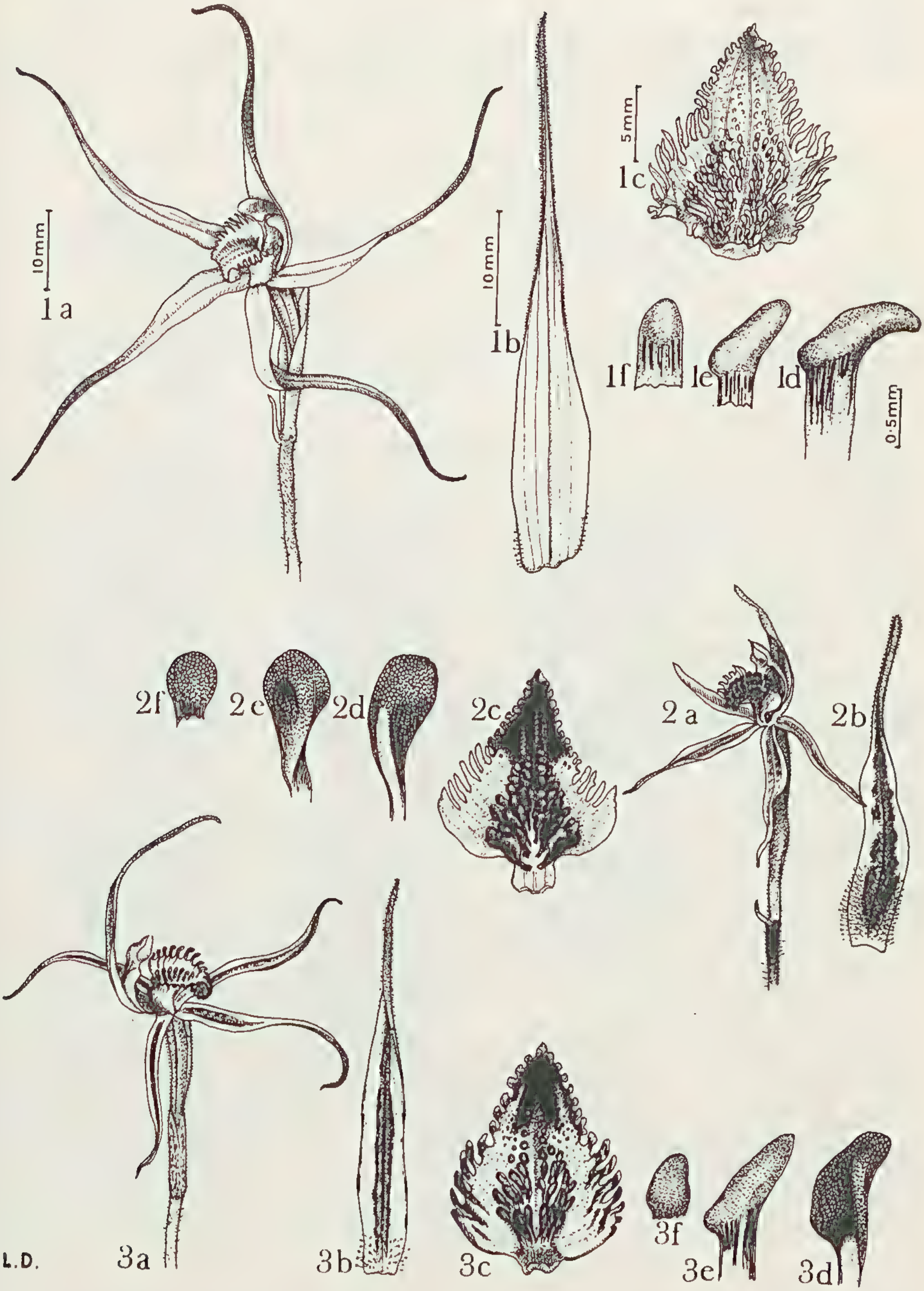


Fig. 1-3 1. *Caladenia patersonii* var. *patersonii;* 2. *Caladenia dilatata* var. *concinna;* 3. Putative hybrid between *Caladenia patersonii* var. *patersonii* and *C. dilatata* var. *concinna.* (a. flower; b, dorsal sepal; c, labellum; d, basal callus; e, central callus; f, apical callus; organs of each species to comparable scales.) Illustration by L. Dutkiewicz.

Voucher specimens

SOUTH AUSTRALIA. Yorke Peninsula Region; Port Vincent, 22°44'S; 137°50'E, *R. Bates* s.n. (AD97629190). This sheet includes specimens of the putative hybrid and of the parents.

Table 1. Characters by which *Caladenia patersonii* var. *patersonii* and *C. dilatata* var. *concinna* differ and the state of these characters in the putative hybrid.

	C. dilatata var. concinna	**Putative hybrid**	**C. patersonii var. patersonii**
Length of dorsal sepal	20-25 mm	28-35 mm	40-45 mm
Length of lateral sepals	18-20 mm	25-35 mm	45-50 mm
Length of lateral petals	14-17 mm	19-28 mm	36-48 mm
Labellum length x breadth	10-12 x 9-11 mm	10-14 x 9-13 mm	13.5-16 x 11-12 mm
Labellum colour	greenish with maroon-purple tip	yellow green with purple tip .	cream-white
Colour of other perianth segments	greenish-yellow with conspicuous maroon stripe reaching the base of the glandular tips (veins dark purple)	yellowish-green with purple stripe not reaching the base of the caudiform tips (veins purple)	whitish-cream without central stripe (veins purple)
Calli at base of labellum	clavate, slightly bent (entirely maroon-purple)	clavate, more bent than in *C. dilatata* (entirely maroon-purple)	bent at nearly a right-angle (purple with white top)
Calli behind base of labellum	remaining fairly straight at all distances behind base of the labellum (purple with white tip)	becoming more bent and white-topped just behind the base of the labellum, similar to *C. patersonii*, and then becoming, less bent and entirely maroon-purple further from the base of the labellum	gradually becoming less bent away from the base of the labellum (purple with white top)

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ENDANGERED SPECIES IN THE SOUTH AUSTRALIAN NATIVE VASCULAR FLORA

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Abstract

A list of 125 South Australian vascular plants considered to be endangered has been prepared by the staff of the State Herbarium of South Australia.

Introduction

With the current level of interest in conservation, a need exists for a dependable list of endangered species of vascular plants in the South Australian native flora. The list prepared by Eichler (in Specht, et al., 1974) provides a great deal of valuable data not otherwise available, but differs from the present list in one important way. It includes numerous species which, although rare or endangered in South Australia, are not immediately endangered in other states. In compiling the present list emphasis has been placed on endemics as these species are entirely dependent on protection within South Australia. Non-endemic species are only included where it is considered that their survival is not sufficiently ensured elsewhere. Specht's (1974) survey has been an important source of data on the status of species in other states, but in many cases adequate data on the range of species outside South Australia was not available to the compilers.

Two serious doubts concern the publication of such a list. One is that it draws the attention of collectors to the very species which should not be collected. It is therefore emphasised that specimens of these species should not be collected except under very special circumstances and then only if the species' survival will not be further jeopardised.

The other doubt is that too much reliability will be placed on the list, resulting in other endangered species being ignored or safe species being excessively protected, on account of their being wrongly classified here. The list must be used with caution.

A principal aim of this list is to provide a basis for discussion and improvement. It is acknowledged that there are undoubtedly errors and that a greater field knowledge of many species is required to establish their conservation needs. The taxonomy of many genera is inadequately understood and future studies can be expected to add new species, while species which have been included may prove not to be distinct. As land uses develop species not now endangered will have to be added and conversely it is to be hoped that, especially through the efforts of the National Parks and Wildlife Service, species can in the future be deleted from the list. Both professional and amateur botanists in South Australia and other states are asked to submit suggestions for improving the list to the State Herbarium of South Australia. It is intended to publish revised lists as the need arises.

List of endangered species of South Australian vascular plants compiled by the staff of the State Herbarium of South Australia.

Monocotyledons

Cyperaceae

Gahnia hystrix J. M. Black
Tetraria halmaturina (J. M. Black) J. M. Black

Liliaceae

Thysanotus fractiflexus N. H. Britt.

Orchidaceae

Caladenia congesta R. Br.
    gladiolata R. S. Rogers
    ovata R. S. Rogers
    rigida R. S. Rogers
    tutelata R. S. Rogers
Corybas fordhamii (H. M. Rupp) H. M. Rupp
Microtis orbicularis R. S. Rogers
Prasophyllum validum R. S. Rogers
Pterostylis cucullata R. Br.
Thelymitra epipactoides F.Muell.
    matthewsii Cheesem.
    truncata R. S. Rogers

Poaceae

Agrostis limitanea J. M. Black
Eragrostis infecunda J. M. Black
Festuca benthamiana Vickery
Poa halmaturina J. M. Black
    umbricola Vickery
Stipa dura J. M. Black
    multispiculis J. M. Black
    nodosa S. T. Blake
    plumigera Hughes

Restionaceae

Lepyrodia valliculae J. M. Black

Dicotyledons

Aizoaceae

Aizoon kochii Wagner
Sarcozona bicarinata S. T. Blake

Amaranthaceae

Hemichroa mesembryanthema F. Muell.
Ptilotus beckeranus (F. Muell.) F. Muell. ex J. M. Black
    eichleranus Benl
    robynsianus Benl
    symonii Benl

Apiaceae
Hydrocotyle comocarpa F. Muell.
crassiuscula Tate

Asteraceae
Achnophora tatei F. Muell.
Angianthus phyllocalymmeus (F. Muell.) Druce
Basedowia tenerrima (F. Muell. & Tate) J. M. Black
Brachyscome muelleri Sond.
Elachanthus glaber P. G. Wils.
Helipterum oppositifolium S. Moore
tenellum Turcz.
Olearia microdisca J. M. Black
stuartii (F. Muell.) F. Muell. ex Benth.
subspicata (Hook.) Benth.

Chenopodiaceae
Atriplex cordifolia J. M. Black
eichleri Aellen
fasciculiflora Aellen
kochiana Maiden
macropterocarpa (Aellen) Hj. Eichler
spongiivalvis Aellen
Bassia aellenii Ising
albolanata Ising
caput-casuarii Willis
cristata Ising
eichleri Ising
holtiana Ising
lanata Ising
nitida Ising
wilsonii Ising
Maireana cannonii (J. M. Black) P. G. Wils.
melanocarpa P. G. Wils.
Malacocera biflora (R. Br.) F. Muell.

Dilleniaceae
Hibbertia paeninsularis J. M. Black

Epacridaceae
Acrotriche halmaturina Paterson
Conostephium halmaturinum J. M. Black

Euphorbiaceae
Poranthera triandra J. M. Black

Fabaceae
Pultenaea trifida J. M. Black
trinervis J. M. Black
viscidula Tate
Sesbania viridis J. M. Black

Frankeniaceae
Frankenia angustipetala Summerh.
cinerea A. DC.
cordata J. M. Black
crispa J. M. Black
cupularis Summerh.
densa Summerh.
eremophila Summerh.
flabellata Sprague
granulata J. M. Black
hamata Summerh.
latior Sprague & Summerh. ex Summerh.
muscosa J. M. Black
orthotricha (J. M. Black) J. M. Black
plicata Melville
pseudo-flabellata Summerh.
speciosa Summerh.
subteres Summerh.

Haloragaceae
Haloragis eichleri Orchard

Lamiaceae
Prostanthera eurybioides F. Muell.
serpyllifolia (R. Br.) Briq.

Mimosaceae
Acacia barattensis J. M. Black
dodonaeifolia Willd. & Spreng.
gillii Maiden & Blakely
imbricata F. Muell.
menzelii J. M. Black
pinguifolia J. M. Black
quornensis J. M. Black
randeliana Fitzg.
rhigiophylla F. Muell. ex Benth.
wattsiana F. Muell. ex Benth.

Myoporaceae
Eremophila pentaptera J. M. Black
santalina F. Muell.
Myoporum brevipes Benth.
refractum Maiden & Betche

Myrtaceae
Darwinia homoranthoides (F. Muell.) J. M. Black
Eucalyptus cneorifolia DC.
remota Blakely
Melaleuca corrugata J. M. Black & Eardley
monticola J. M. Black

Pittosporaceae
Cheiranthera volubilis Benth.

Portulacaceae
Calandrinia dipetala J. M. Black
    disperma J. M. Black
    sphaerophylla J. M. Black

Proteaceae
Grevillea parallelinervis Carrick
    rogersii Maiden
    umbellifera J. M. Black
Petrophila multisecta F. Muell.

Rhamnaceae
Cryptandra uncinata (F. Muell. ex Baill.) Gruning

Rutaceae
Phebalium hillebrandii Willis

Sapindaceae
Dodonaea tepperi F. Muell. ex Radlk.

Scrophulariaceae
Euphrasia scabra R.Br.

Stackhousiaceae
Stackhousia annua Barker

Thymelaeaceae
Pimelea macrostegia (Benth.) J. M. Black

Zygophyllaceae
Zygophyllum hybridum Tate
    kochii Tate

Acknowledgements

The assistance and advice of Dr. S. Barker (National Parks and Wildlife Service) and Mr. R. Bates (who compiled the list of orchids) is gratefully acknowledged.

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NOTES ON THE SOUTH AUSTRALIAN FLORA

Various Authors

Hypecoum pendulum L. (Papaveraceae) in South Australia

The first published report of the naturalization of *Hypecoum pendulum* L. (1753) in Australia appeared recently, when Aston (1976) described the collection of this species at Lake Boga in northern Victoria in 1970 and again at a second nearby locality in 1973 to 1975.

In 1966, two collections were made by B. Copley of *Hypecoum pendulum* (s.l.) in Section 125 of the Hundred of Tickera, northern Yorke Peninsula, South Australia (i.e. c. 60 km north-west of Port Wakefield). He reported that the species was common on a firebreak on mallee loam soil. It was less common over approximately 10 acres (4.05 ha.) of cultivated land. The annual rainfall in the area is c. 340 mm which is comparable with that in the Lake Boga region. No further collections have since been made in South Australia and it is not known whether or not it has persisted.

Aston outlined the taxonomy of the *H. pendulum* complex, which includes also *H. parviflorum* Kar. & Kir. (1842) and *H. trilobum* Trautv. (1884, p. 366). On advice from Tutin, co-author of the treatment of the genus in 'Flora Europaea' (Mowat & Tutin, 1964), she accepted the concepts of Cullen (1966), recognizing a single species with three varieties. The varietal status of the Victorian material was not stated, but it was suggested that the specimens combined characters of var. *parviflorum* (Kar. & Kir.) Krylov (1931) and var. *trilobum* (Trautv.) Cullen (1966, p. 25).

The Yorke Peninsula specimens agree well with Aston's description and the Victorian collections, except in flower size. The outer petals of the Victorian collections are 9-10.5 mm long and 10-11.5 mm broad, while those of the South Australian material are approximately 7 x 5 mm. In petal size the South Australian material appears to agree with *H. parviflorum* according to measurements given by Popov, (1937), but in shape rather with *H. trilobum*. Tutin's comments (quoted by Aston) that the Victorian specimens combine characters of both these taxa appears, therefore, to be even truer of the South Australian specimens.

Hypecoum differs from other genera of Papaveraceae recorded for South Australia by Black (1948) in having regular flowers, petals without spurs, 4 stamens, the style shortly 2-lobed at the apex, and capsule narrowly fusiform, indehiscent and with up to 10 seeds.

The following brief description is based on that of Aston and on the specimens from Yorke Peninsula.

Plant annual, glabrous, up to 40 cm high, with a strong curry-like odour even after drying; branches erect or ascending. *Leaves* usually less than 10 cm long, mostly basal, deeply and finely divided. *Pedicels* solitary at nodes or terminal, slender, thickening and lengthening to 2 cm long in fruit. *Sepals* 2, ovate, 2-2.5 mm long. *Petals* 4, yellow; the outer to 7 (-10.5) mm long and to 5 (-11.5) mm broad, distally (entire or) shallowly 3-lobed; inner 2 with several scattered purplish oblong spots, shorter than the outer petals, deeply 3-lobed. *Stamens* 4, opposite the petals, c. 6.5 mm long; anthers basifixed, each with a minute apical projection. *Ovary* slender; style bearing two very short divergent stigmas. *Capsule* narrowly fusiform, 4-6 cm long, 2.5-4 mm wide at the broadest part, pendulous from the apex of the recurved pedicel, hard, indehiscent. *Seeds* up to 10, 2-2.5 mm long.

SOUTH AUSTRALIA: Yorke Peninsula Region, northern boundary of Section 125, Hundred of Tickera, *Copley 660* (AD, CANB), *772* (AD, E).

This species originates from southern Europe, south-western Asia and North Africa.

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Astragalus L. (Fabaceae) in South Australia

J. M. Black (1948) recorded a single species of *Astragalus, A. hamosus* L., in South Australia, occuring in the "Flinders Range from Baroota to Hawker." The species is now known from a wider area and a second species has been recorded.

Key to Astragalus species in South Australia.

1. Peduncles 3-5 cm long; legumes 2-5 cm long, strongly curved; hairs on stem and branches medifixed .... *A. hamosus*

1. Peduncles less than 0.5 cm long; legumes 1-1.5 cm long, straight and erect; hairs on stems and branches mainly basifixed .... *A. sesameus*

Astragalus hamosus L. (1753).

Since 1948 this species has been found in Eyre Peninsula, in the Eastern Region and in further localities in the Flinders Ranges Region:

SOUTH AUSTRALIA. Flinders Ranges Region: *J. M. Black s.n.* (AD 97338067), Hawker, 4.x.1916 & 18.x.1917, (31° 53′S, 138° 25′E); *J. M. Black s.n.,* (AD97338067), Baroota, 9.ix.1936, (32° 56′S, 137° 59′E); *R. L. Crocker s.n.* (ADW 45750), Hawker, 18.ix.1939; *R. D. Pearce s.n.* (ADW 42975); on roadside ca. 3 km south from Melrose to Gladstone, 23.ix.1973, (32° 51′S, 138° 12′E); *R. D. Pearce* 2, (ADW 45180), Hawker, 15.ix.1974. Eyre Peninsula Region: *E. Kehn s.n.* (AD 97339016), Hundred of Glynn, 25.ix.1973, (approx. 33° 30′S, 136° 55′E); *E. Kehn s.n.* (ADW 42976), Near Cowell, 5.x.1973, (33° 41′S, 139° 59′E).

Astragalus sesameus L. (1753)

In 1968 Mr. D. E. Symon collected this species near Mundy Creek in the Flinders Ranges Region. In 1973 it was collected three times near Yunta in the Eastern Region with a note on one specimen, that the species had occurred in the region for at least the previous ten years. Also in 1973 the author collected it in the Brookfield Zoo Wombat Reserve, Blanchetown (34°20'S, 139°30'E), in the Murray Region, where the plants were widespread in an area of about 1 hectare, some 2km east of the homestead on sandy soil in light scrub of *Atriplex suberecta* Verdoorn, *Bassia diacantha* (Nees) F. Muell., *Eremophila scoparia* (R. Br.) F. Muell., *Geijera linearifolia* (DC.) Benth., *Maireana excavata* (J. M. Black) P. G. Wilson and *Maireana pentatropis* (Tate) P. G. Wilson. Like the other localities where this species has been found, the Reserve had been a pastoral station, and the species may have been introduced accidently with pasture seed. The Reserve has been established since 1971.

The species, the identification of which was kindly confirmed by Dr. C. Steinberg, Conservator of the Herbarium of the University of Florence, is native to the Mediterranean region of Europe, occurring from southern Portugal to southern Bulgaria, in Turkey and North Africa, (Chater, 1968). It is not known to be cultivated for either economic or ornamental purposes, and no record has been found of its occurrence in other states of Australia.

Plant an herbaceous annual; *stem* prostrate or ascending to 25 cm, 1-2.5 mm thick, pubescent. *Leaves* 3-8 cm long, imparipinnate; leaflets 15-27, oblong, ca. 1 cm long, grey pubescent on both sides. *Stipules* triangular, acute, 3-5 mm long, pubescent. *Flowers* 5-10, subsessile, each subtended by a narrow triangular acute pubescent bract, borne in dense, shortly pedunculate axillary raceme. *Calyx* up to 6 mm long; lobes narrow triangular, acute, as long as the narrow tube, long-pubescent, green. *Flowers* yellow or bluish, standard narrow, obovate, slightly longer than keel and calyx; wings long-clawed, lamina ovate, auriculate; keel obtuse with two auricles. *Stamens* adnate to the keel for two thirds of their length; upper stamen free. *Ovary* pubescent. *Legume* erect, 10-15 mm long, 3-4 mm broad, subsessile, cylindrical pubescent. *Seeds* angular ca. 1 mm across, olive-green.

SOUTH AUSTRALIA. Flinders Ranges Region: *D. E. Symon 5600*, (ADW 42977), creekline 24 km north-east of Mundy Creek, 15.viii.1968, (30°03'S, 138°38'E). Eastern Region: *J. Lewis s.n.* (ADW 42926), Yunta between road and railway line, 16.vii.1973, (32°35'S, 139°34'E); *A. Tiver s.n.* (ADW 43298), Spring Dam Station, via Tiverton, 3.ix.1973, (approx. 32°55'S, 139°40'E); *A. Tiver s.n.* (ADW 42978), Spring Dam Station, via Yunta, 9.ix.1973. Murray Region: *J. Z. Weber 3573*, (AD 97347096), Brookfield Zoo Wombat Reserve, Blanchetown, 2.x.1973.

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A SELECTION OF AUSTRALIAN FLOWER PAINTINGS BY FERDINAND BAUER

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The publication in February 1976 of 'The Australian Flower Paintings of Ferdinand Bauer' by the Basilisk Press with an introduction by Wilfrid Blunt and botanical text by William T. Stearn is particularly worthy of note. This is so not only because of the volume's obvious size, quality and price, but because it makes available to a wider public a selection of 25 of the outstanding plant drawings of Ferdinand Bauer, nearly all of them previously unpublished. At a selling price of £420 few people will afford to purchase a copy, nor will many libraries, but such an outstanding publication calls for comment and for an account within reach of all to read.

Ferdinand Bauer and his elder brother Franz (or Francis as he later came to be known) are between them, in the opinion of many people, the greatest botanical artists of all time; not only because of the exceptionally high quality of the lifelike and aesthetically pleasing plant portraits they painted, but because they included in their compositions careful, painstaking, botanically significant and accurate dissections and enlargements of the flower parts. It may be argued that it is the very addition of these drawings of selected and magnified parts which marks off botanical art from plant portraiture, yet, with the Bauers, the whole forms a composition of such quality and beauty as to represent one of the highest forms of art. It is interesting to note, however, that Ferdinand Bauer's work did not always include such detailed studies, as may be seen by comparing his plates in Sibthorpe & Smith's famous 'Flora Graeca' (1806-1840) with the paintings in the work under review, a change in practice which, according to Stearn, is attributable to the influence and inspiration of Robert Brown. (Incidentally, a similar change in a work portraying present-day drawings of Australian plants may be seen by comparing the first part of 'The Endemic Flora of Tasmania' by Margaret Stones & Winifred Curtis (1967) with those which have been published subsequently where Miss Stones has skilfully added enlargements of the botanically important details to her beautiful portraits of Tasmanian plants).

Despite the undoubted quality of Ferdinand Bauer's drawings his output was remarkable; on his expedition to Australia between 1801 and 1805, and often under the most adverse and cramped conditions at sea, he made more than 2000 drawings of natural history objects, some three-quarters of which were Australian plants (including some from Norfolk Island). Over three hundred of these are today in the collections of the British Museum (Natural History), 236 meticulously finished paintings of plants and 89 of animals. Very few have ever been published, even in black and white, and it is from among these paintings that the 25 plates used in this recent work have been carefully selected. Only three appear to have been published before and none of them exactly as they appear in this work. Plate 6, *Flindersia australis,* was used as the first plate in the atlas that accompanied Flinders' 'Voyage to Terra Australis' (1814), although in black and white; Plate 15, *Brunonia australis,* appeared as a rather crude and somewhat modified line drawing in the *Transactions of the Linnean Society,* Volume 10, as Plate 29 in 1811 (the beautiful coloured drawing of this same species which constituted Plate 10 in Bauer's 'Illustrationes Florae Novae Hollandiae' (1813) would seem to have been based on another Bauer drawing altogether). Portions of Plate 24, *Eustrephus latifolius,* were used in black and white as Plate 4 of Endlicher's 'Iconographia' (1838).

Once it had been decided to publish this magnificent volume it was advertised and a prospectus distributed giving details of the intended work and its technical specifications. Although the book sells at £420 it was available by pre-publication subscription at £305 before 1 April 1975. The volume is a folio with a full page size of 18 x 25¼ inches and the greatest care over quality has been taken at all stages of its production. Technical details, together with the names of the firms from Britain, France and Sweden making or supplying the paper for the text, for the plates and for the mounts, or the leather binding material and the special marbled side papers, are set out in an extended colophon on the back page. The book was designed and produced by Peter Guy and a total of 515 copies printed, 500 for sale. Each copy is individually numbered and in order to ensure their continued exclusiveness all the plates were destroyed after printing, with no possibility of the edition being extended or repeated. Furthermore, the Trustees of the British Museum (Natural History) undertook not to allow the drawings appearing in this volume to be reproduced full-sized again by anyone before 30 Nov. 1976 nor thereafter in colour facsimile.

After a short 'Preface' by W.T. Stearn of the British Museum (Natural History), the 'Introduction' by Wilfrid Blunt (Curator of the Watts Gallery, Compton) presents (pp. 9-22) an account of Flinders' voyage — an introduction which is a necessary background for an understanding and full appreciation of the plates that follow. In it we learn much of Matthew Flinders, who was appointed Captain of H.M.S. *Investigator,* an ancient 334 ton sloop, in his 27th year when he was given the task of charting the unknown coast of Australia. For the voyage, Ferdinand Bauer was appointed natural history artist and Robert Brown botanist, the former aged 41 and the latter, released from the army, 28. Most of the 'Introduction,' however, is taken up with the voyage itself, written in a style, the quality of which matches the book, and recounting vividly the conditions under which Brown and Bauer worked, and the course which the ship took, with the landing places where, faced with limited time and a tremendous diversity of new plants, they collected assiduously. The adventures and tragedies suffered by Flinders as a result of his wreck on the Great Barrier Reef and, later, his long imprisonment by the French on Mauritius — while Brown and Bauer worked away in the Port Jackson Colony or visited Tasmania and Norfolk Island respectively — all make fascinating reading.

Of particular significance in this 'Introduction' is the authoritative critique by Wilfrid Blunt of Bauer's work. For many people, Blunt established his position as an undoubted authority on botanical art when in 1950 his book 'The Art of Botanical Illustration' was published. Ferdinand Bauer's style and technique are thus assessed and judged from a background of wide experience and knowledge, and Blunt's praise is praise indeed.

W.T. Stearn follows this 'Introduction' with a chapter entitled 'The Contributions of Robert Brown and Ferdinand Bauer to Australian Botany.' In it Brown is described as the greatest botanist ever to have set foot in Australia. The fame of Brown is essentially based on his acute ability to observe things, recognize their significance and record them; thus, on the voyage, he described every plant directly in Latin in the greatest detail, including in some instances such fine details as the characters of the pollen. He drew up some 6000 descriptions in all — collecting nearly 3900 species, a total which included 1700 new to science and 140 new genera. These careful, meticulous, but still unpublished descriptions today occupy 72 "Solander Boxes" at the British Museum (Natural History). However, just as so little of the work of Banks and Solander on Captain Cook's first voyage was ever published, so it seems a tragedy that the results of such prodigious industry as that shown by Robert Brown should also have lain unpublished, today overtaken at least in part, by other publications. Nevertheless, there is still much of value to be learnt from Brown's descriptions, for few people, if any, have looked so carefully at such a wide range of Australian plants or recorded so methodically their characters. For Australian botanists it is worth noting that his descriptions were microfilmed by Dr. Nancy T. Burbidge in 1953, when she was Australian Liaison Botanist in Britain, and in this form are all available for consultation in Canberra.

Due to the economic climate of the period and the drain on resources caused by the Napoleonic wars, the beginning of the 19th Century was not a time to encourage botanical publications. In 1810, at his own expense, Brown published the beginning of his 'Prodromus Florae Novae Hollandiae.' Volume 1 cost him £93.14.4½d to publish but only 26 of the 250 copies were sold and after this failure in public response he gave up work on the 'Prodromus' altogether. In it, without illustrations, he published not descriptions, but short, succinct diagnoses, and although their scientific excellence has always been held in high regard, the work was no doubt dry and lacking in interest for all but the most knowledgeable and discerning botanists. Even the publication of some of Bauer's drawings met a similar fate. In 1813 he commenced publication of his 'Illustrationes Florae Novae Hollandiae' with the appearance of fifteen plates in three parts, but they met with such a poor reception that only fifty copies were produced. Bauer, depressed by apparent failure returned to his native Austria, presumably taking with him most of his drawings, his own property by agreement before the voyage with Flinders.

The chapter on Brown and Bauer by Stearn is followed by a large map on two facing pages captioned 'The Voyage of H.M.S. *Investigator* and of the *Porpoise* and the *Cumberland,* which were used when the *Investigator* was no longer seaworthy. Showing the localities where the plants illustrated in this volume were collected. Based on Captain Matthew Flinders' "General Chart of Terra Australis".' The geographical localities where the plants were collected on this voyage are therefore well documented because in addition to this large and detailed map a small one is printed on the page before each of the 25 individual plates which make up the main part of the volume. They show the places from which the individual species were collected, marked with the symbols in the form of capital letters which were used by Brown to indicate the general areas from which collections were made. These are explained in detail in this volume, as earlier elucidated in Dr. Burbidge's 'Robert Brown's Australian Collecting Localities', published in the *Proceedings of the Linnean Society of New South Wales* 80: 229-233 (1956), or in Stearn's 'Introduction' to the facsimile edition of Robert Brown's 'Prodromus Florae Novae Hollandiae' which was issued in 1960.

It is the selected 25 coloured plates which are the main part of this volume — the primary reason for its publication — which will strike everyone turning to or reading it. Between them they illustrate Bauer's great range of artistry and craftsmanship. The plants illustrated are:

Plate 1 *Cycas media* R. Br. (Cycadaceae)
Plate 2 *Hibbertia dealbata* (R. Br.) Benth. (Dilleniaceae)
Plate 3 *Cochlospermum gillivraei* Benth. (Cochlospermaceae)
Plate 4 *Alyogyne hakeifolia* (Giord.) Alef. (Malvaceae)
Plate 5 *Abelmoschus moschatus* Medik. subsp. *tuberosus* (Span.) Borssum (Malvaceae)
Plate 6 *Flindersia australis* R. Br. (Rutaceae)
Plate 7 *Callicoma serratifolia* Andr. (Cunoniaceae)
Plate 8 *Verticordia brownii* (Desf.) DC. (Myrtaceae)
Plate 9 *Kunzea baxteri* (Klotzsch) Schauer (Myrtaceae)
Plate 10 *Eucalyptus pruinosa* Schauer (Myrtaceae)
Plate 11 *Macklinaya macrosciadea* (F. Muell.) F. Muell. (Araliaceae)
Plate 12 *Nuytsia floribunda* (Labill.) R. Br. ex Fenzl (Loranthaceae)
Plate 13 *Muellerina eucalyptoides* (DC.) Barlow (Loranthaceae)
Plate 14 *Stylidium scandens* R. Br. (Stylidiaceae)
Plate 15 *Brunonia australis* Sm. ex R. Br. (Brunoniaceae)
Plate 16 *Dracophyllum secundum* R. Br. (Epacridaceae)
Plate 17 *Myristica insipida* R. Br. (Myristicaceae)
Plate 18 *Banksia speciosa* R. Br. (Proteaceae)
Plate 19 *Dendrocnide excelsa* (Wedd.) Chew (Urticaceae)
Plate 20 *Ottelia ovalifolia* (R. Br.) Rich. (Hydrocharitaceae)

Plate 21 *Dendrobium discolor* Lindl. (Orchidaceae)
Plate 22 *Cymbidium suave* R. Br. (Orchidaceae)
Plate 23 *Diuris maculata* Sm. (Orchidaceae)
Plate 24 *Eustrephus latifolius* R. Br. (Liliaceae)
Plate 25 *Lomandra hastilis* (R. Br.) Ewart (Xanthorrhoeaceae)

These plates have been printed with the greatest care by off-set lithography using up to ten colours per plate, not the usual four or even six colour process. The result is superb. Even though techniques of colour printing have reached a high standard today, witness for example the present-day plates in *Curtis's Botanical Magazine* (where a six colour off-set lithography is used) there is usually a distinct loss when they are compared with the original art work. However, in 'The Australian Flower Paintings of Ferdinand Bauer' when one compares the published plates with the original drawings at the British Museum, as I have been privileged to do, one is struck by the faithfulness of the reproductions. The texture and tone of the originals come through in the printed work and the reproduction of even the finest details, such as hairs and ciliations, is remarkably true.

Each painting, with its corresponding text, can be considered as a separate article, and before each plate the full synonymy of the plant is presented, together with standard and important references and the individual maps mentioned above. These are followed in every case by an interesting account by W.T. Stearn dealing with the particular plant depicted. Usually, this occupies the page facing the plate but in three exceptions, those of *Cycas media, Brunonia australis* and *Cymbidium suave,* it overflows, or rather commences, on the previous page beneath the synonymy and map. In these articles Stearn gives the full and detailed Latin description drawn up by Brown while on the voyage in all except for three cases, where they appear to be non-existent, and he contrasts them, where appropriate, with the short diagnoses Brown published in his 'Prodromus'. Stearn also includes interesting facts relating to the plant, especially to each discovery and collection by Brown and Bauer, or by earlier collectors such as Banks and Solander. In nearly every one of the accounts he reveals his interest in plant names by explaining the origin and meaning of the name, either from the Greek or the Latin, or in the case of generic names or epithets based on those of a person's name, by telling something about the person concerned.

A full appreciation of the botany of Australia must include the historical background, and while for some this may be obtained over a period by extensive and wide reading, much may be learned from the text of this volume. Quite apart from the pleasure of viewing Bauer's drawings, anyone who can consult a copy, whether in private hands or public library, will find the text excellently written and informative; with interest and fascination they will quickly learn the important facts about Flinders' voyage and about Robert Brown and Ferdinand Bauer.

As with all good plant books, the volume is completed by an 'Index of Plant Names.' However, considering the sumptuous character of the book, the undoubted care that has been put into its production and the price at which it has been sold, it was with some surprise that I noted a number of small errors, most of them presumably missed in proof: Bauer's drawings made on Norfolk Island in 1804 were not in fact "used to illustrate Stephen Endlicher's 'Prodromus Florae Norfolkicae' " (p. 21) — clearly they had been intended to have been so used, for the text includes reference to them, but they never actually appeared; the generally accepted and correct name for the Norfolk Island pine today is *Araucaria heterophylla* not *Araucaria excelsa* (p. 21) — even though unfortunately this latter is better known; on the contents page we find the combining botanical authority for the name of the plant depicted in Plate 5 spelt as "Borrsum" instead of "Borssum" and further down mention of "van Mueller" instead of "von Mueller"; and the authority for *Stylidium kunthii* is not "Wall ex DC." but Wall. (or Wallich) ex DC. These minor criticisms are trifling though when compared with the general excellence of this work.

If there is one general feeling of unease over this publication, however, it lies in the continued rarity of Bauer's plates. Like many treasures in national museums the world over they are preserved for posterity but rarely seen and certainly not available for study or reference by the general public. As shown years ago by Britten in his paper 'Ferdinand Bauer's Drawings of Australian Plants,' in the *Journal of Botany* 47: 140-146 (1909),a number of Bauer's drawings have been used, yet they constitute but a fraction of his total output and only a few of those which still exist in national collections. For his coloured drawings, only the expensive methods and high quality paper used in this edition can do justice to the full beauty of his work, and as a result publication must be costly, but at what stage is a more lowly priced publication justified, in order to make the drawings available to a wider public, without sacrificing too much quality and yet still doing justice to the artist? The days of exclusive privilege are gradually passing, especially when based on wealth, yet it must be said that at present one must accept that even these 25 plates would never have been published and reproduced 515 times, except in an expensive book — a collector's item from the moment of its advertisement. Nevertheless, however rare these faithful reproductions remain, at least a few copies of a selection of Bauer's drawings are now available in Australia, from whence the subjects originally came, where, in the possession of a fortunate few or in public libraries, botanists and admirers can consult them.

J. Adelaide Bot. Gard. 1(2): 151-160 (1977)

PLANT PORTRAITS

From time to time as suitable material becomes available for illustration, hitherto poorly figured, or poorly documented species will be featured to assist identification, or to provide records in cases where taxa may be threatened with extinction. The descriptions will be based on living material which should be a help where herbarium specimens have formed the basis for description of the type.

This series may also provide an opportunity for the skills of Australian and other botanical artists to be brought together for their own intrinsic value, and to allow comparison and a record of different styles of execution.

The editors will be glad to receive line drawings of appropriate quality and text arranged in the following format, particularly from workers specialising in groups for which there is a poor iconography or poor documentation. The formal description and illustration of new species and notable cultivars may also be submitted, as may comparative drawings and descriptions which assist with the identification of critical botanical and horticultural groups of vascular plants.

Plant Portraits 1-3 were drawn by L. Dutkiewicz, the botanical artist of the Adelaide Botanic Garden.

4. Didymocarpus kinnearii F. Muell. (Gesneriaceae)

Didymocarpus kinnearii F. Muell., *Vict. Nat.* 3 (11): 159 (1887 March); *Bot. Centralbl.* 30: 278 (1887).

Synonym: *Roettlera kinnearii* (F. Muell.) Fritsch in Engl. & Prantl (eds). *Die natürl. Pflanzenfam.* 4. (3b): 147 (1894).

Flowered Adelaide Botanic Garden on December 1, 1976, accession number 17-77, herbarium voucher AD Herb. Pl. Cult. 6985. Collected by T.R.N. Lothian from Rex Creek, Mossmann River, Mt. Lewis plateau alt. c. 1250m., Queensland on September 5, 1976.

Perennial *herb,* c. 10 cm tall; *rhizome* horizontal, brown, clad with transparent hairs and old leaf bases, c. 4 cm long, 1 cm thick; *roots* arising from along length of rhizome, initially white, c. 1 mm thick, soft, later fibrous; *leaves* c. 6.8 cm long, 4 cm wide at widest part, ovate, irregularly and sometimes doubly serrate, leaf base ± cordate, adaxially softly pilose, hairs transparent, 6-8 celled, c. 2.5 mm long, lamina rugose, glossy, green, lateral veins c. 7, impressed, abaxially softly pilose especially on raised veins, hairs transparent, 6-8 celled, c. 2.5 mm long, lamina pale matt green; *petiole* c. 4.5 cm long, 2 mm thick, circular in cross section, flattened at base, 3.5 mm wide, stipular tufts of hair, vestiture adpressed, transparent, 5-8 celled; *flowers* on erect axillary *peduncle* c. 6.5 cm long, flushed purple below, fading to pale green, spreading pilose, hairs transparent; *pedicels* c. 5 mm long, cymose, glabrescent, pale green to white, bracteate; *bracts* c. 4 mm long, to 1 mm long toward apex of inflorescence, spathulate, pale green, transparent pilose; *sepals* 5, shortly fused at base, 1.5 mm long, white with greenish tip, spreading transparent pilose, hairs 4-5 celled; *petals* 5, fused at base, tube c. 2 mm long, free lobes ovate, tips rounded, c. 4 mm long, c. 3 mm wide, sinuses between lobes minutely puckered, imbricate in bud, pale lilac, when expanded white with faintest lilac flush, glabrous; *stamens* 2, inserted opposite each antero-lateral and anterior corolla lobe sinus, remaining 3 stamens vestigial, each less than 1 mm long, filiform; *filaments* of fertile stamens c. 2 mm long, white, sigmoid curved; *anther* 1 mm long with distal and proximal horns, yellow, connective swollen, white, initially adherent together; *ovary* 1mm long at anthesis, bilocular, violet; *style* 4 mm long, white flushed violet, exserted 2 mm outside bud (when bud c. 3 mm long); *stigma* capitate, papillose, white; *ovules* pale brown, numerous; *fruit* fusiform, erect, straw coloured, 9 mm long, 1.5 mm wide, beak 4 mm long, valves 4, spirally twisted; *seeds* c. 0.7 mm long, brown, ovoid.

Didymocarpus kinnearii F. Muell. commemorates Robert Kinnear, "a strenuous promoter of horticulture at our metropolis", according to Mueller (1887) in an article published in March of that year, and made the more memorable by also containing the description of *Rhododendron lochae* F. Muell. However, Kinnear did not discover the *Didymocarpus.* It was collected by Messrs. Sayer and Davidson at, and near, the summit of Mount Bellenden Ker in Queensland, their type material being later housed at Melbourne.

Mueller stated that *D. kinnearii* "comes near to *Baea* (sic), and recedes from most of its congeners". When unnamed material flowered at Adelaide after being collected by Noel Lothian in the vicinity of Mount Lewis in September 1976, the plants were taken to be a *Boea.* Enquiries to Mr. B. L. Burtt at the Royal Botanic Garden, Edinburgh, provided the correct identity of the plant based on comparison with the type, which Burtt happened to have on loan from Melbourne at the time. It also seemed that the Lothian collection, about 70 miles north north west of the type locality, was the first since the taxon was described, because Brisbane held no material. However, Mr. B. Hyland kindly sent unidentified *Dockrill 806* from North Mary Logging Area, 16° 30'S, 145° 15'E (QRS 007742) collected 20.i.1974, and *Flecker 6394* from the east slope of Mount Bartle Frere (QRS 007741) collected 28.x.1939, and identified as *Boea hygroscopica* F. Muell. by C.T. White on 25.i.1940. Both specimens, from the Forestry and Timber Bureau at Atherton, Queensland, appear to be *D. kinnearii,* and are fruiting.

The question of the assignation of the species into an appropriate genus is still unresolved. Mr. Burtt observes (personal communication January 24, 1977), "Despite the fact that the fruit on the type does not really twist, I have a strong feeling that this very isolated *'Didymocarpus'* is really an anomalous species of *Boea.* There are no fully ripe (dehisced) fruits on the type . . . . .".

Field observations are required to confirm if the exserted stigma at bud stage of flowering signifies a protogynous breeding system, or whether it represents a condition created by cultivation. The leaves die down completely in our summer.

Mueller, F. v. (1887). Descriptions of new Australian plants. *Victorian Naturalist* 3(11); 159-60.

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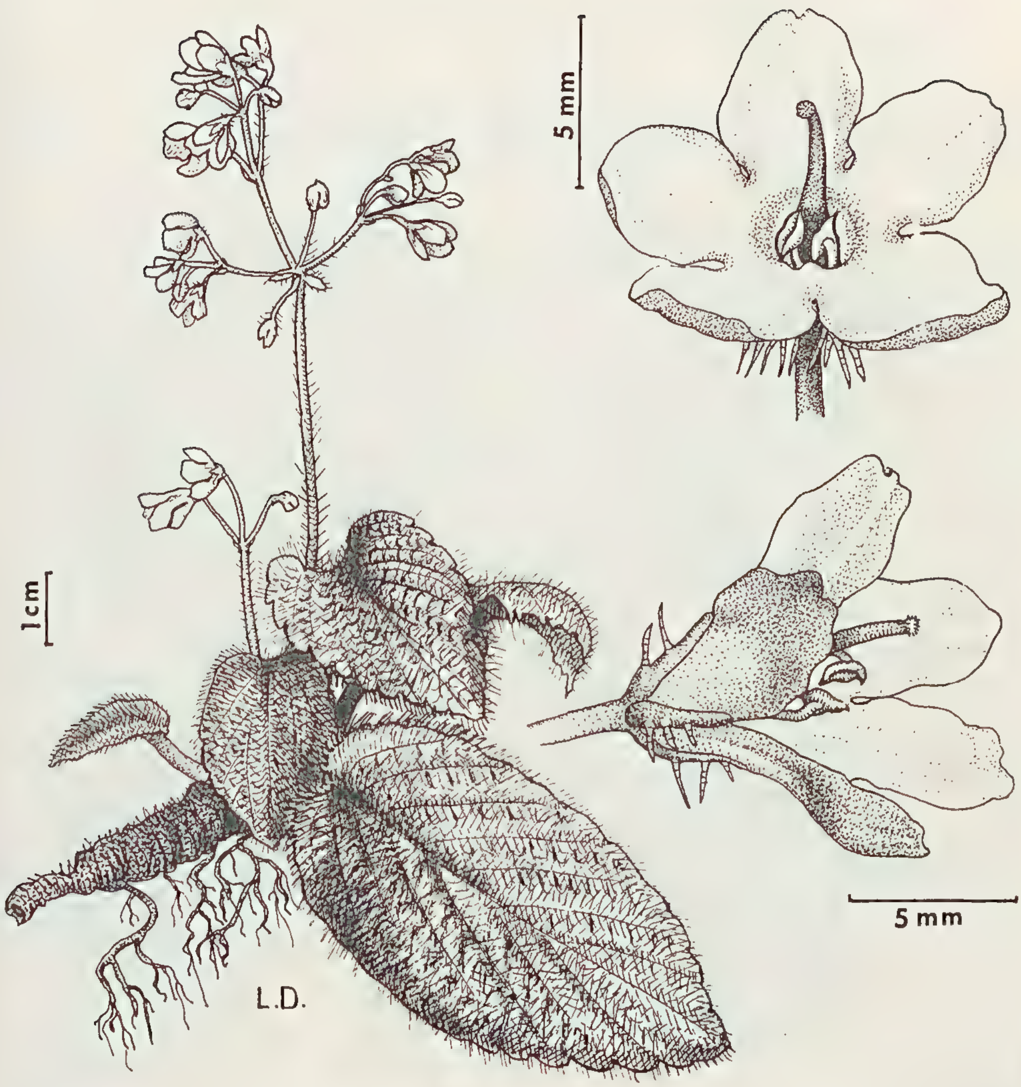

flowering plant with two views of flower

5. Dendrobium isochiloides Kränzl. (Orchidaceae)

Dendrobium isochiloides Kränzl., Österr. bot. Zeitschr., 334 (1894).

Flowered Adelaide Botanic Garden on April 29, 1976, accession number 202-73, herbarium voucher AD Herb. Pl. Cult. 6394. Collected from Kassam Pass, Morobe Province, Papua New Guinea, alt. c. 1000 m. by collector for the National Herbarium and Botanic Garden, Papua New Guinea.

A perennial *herb* c. 16 cm tall, caespitose; *rhizome* short, roots c. 1.5 mm diameter, spreading; *stems* slender, compressed, c. 0.75 mm diameter, leafy to base; *leaves* linear-oblong, c. 2 cm long, 2 mm wide at widest point, twisted through 90° gradually throughout whole length, apex obliquely notched, c. 1 mm deep, midrib of two pale green grooves above, a single pale green vein on either side, interconnected with right-angled veins, reticulations rough but with sheen, veins similar underneath, more glossy, dark green, leaf sheaths c. 7 mm long, greenish-purple above, becoming chestnut near base of stem; *pedicels* axillary, 4.5 mm long (including ovary), pale green, subtending bract 1.5 mm long, pale green; *flowers* small but attractive, c. 9 mm long, *outer tepals* at first directed forward, later all reflexed, *laterals* c. 9 mm long including mentum, 5 mm wide at base, pale green, glossy, glabrous, *dorsal tepal* c. 5 mm long, 2 mm wide at base, colour and texture like laterals, *mentum* c. 5 mm long, 4 mm wide, obtuse at closed end, pale green, glossy, *inner lateral tepals* reflexed, c. 5 mm long, 0.5 mm wide at base, pale green, *lip* posterior in bud, later anterior by resupination, c. 7 mm long, mobile, somewhat convex, spathulate, tip fleshy, pale brown with minute purple papillae, limb glossy, narrowed at base, channelled, purple blotched, margins with two erect wings, c. 4 mm long, 1 mm high, wing tips acute; *column* curved, blotched purple on green ground; *rostellum* purple; *pollinia* four, yellow; *fruits* not seen.

I am grateful to Mr. J. Womersley for helping confirm the identity of this cultivated material in the absence of an up to date key. The taxon is allied to *D. obovatum* Schltr., *D. poneroides* Schltr. (synonym, *D. isochiloides* Kränzl. var. *pumilum* J. J. Sm.), and *D. macrum* Schltr., all illustrated in Schlechter, R., *Repert. Spec. Nov. Regni Veg. Beih.*, Bd.21, Figuren-Atlas zu den Orchidaceen von Deutsch-Neu-Guinea, Tafel CCXI, Nrs. 795, 796 and 797 in that order. *D. poneroides* is also illustrated in *Nova Guinea* 8: t. 26 (1909), there being a flower with dissections.

Plants of *D. isochiloides* grow easily in a pot of pine bark in the Adelaide orchid house, and flower sporadically throughout the year.

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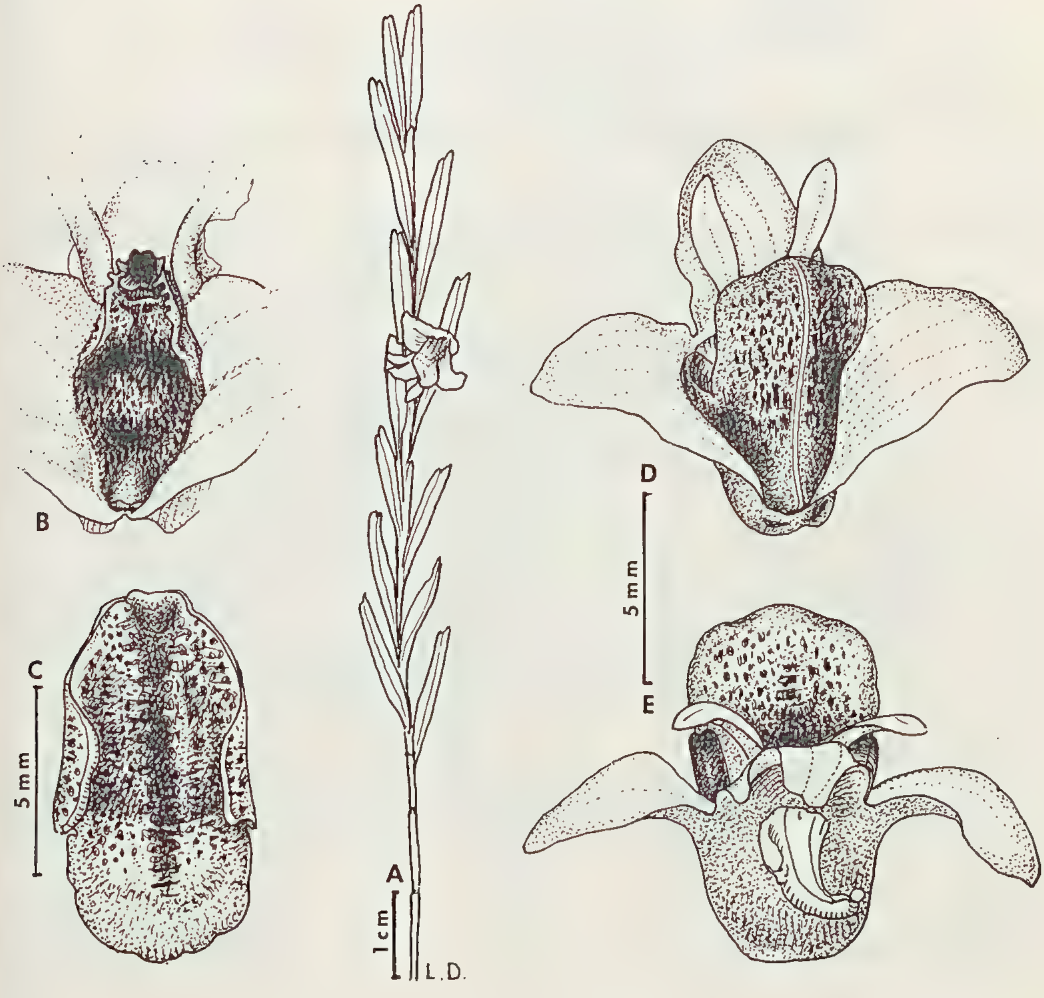

a. flowering plant, b. detail of column, c. lip from above, d. flower from below, e. flower from above.

6. Mediocalcar abbreviatum Schltr. (Orchidaceae)

Mediocalcar abbreviatum Schltr., *Repert. Spec. Nov. Regni Veg. Beih.,* Bd. 1, Heft 3, 229-30 (1911).

Ic. *Repert. Spec. Nov. Regni Veg. Beih.,* Bd. 21, Figuren-Atlas zu den Orchidaceen von Deutsch-Neu-Guinea. Tafel LXXXV, Nr. 311 (1923-28), flower with dissection only.

Flowered Adelaide Botanic Garden on May 20, 1976, accession number 229-74 (15), herbarium voucher AD Herb. Pl. Cult. 6357. Collected from Mount Kaindi, Morobe Province, Papua New Guinea, alt. c. 2000 m. by collector for National Herbarium and Botanic Garden, Papua New Guinea.

Perennial *herb* c. 14 cm tall, spreading; *rhizome* invested in white-veined brown sheaths when old, c. 2 mm diameter; *roots* aerial, protruding through sheaths, wiry, slender, sparsely branched, c. 9 cm long, c. 0.5 mm diameter, reddish at first, later brown, minutely puberulous; *pseudobulbs* single leaved, truncate when old, c. 2.5 cm long, c. 2.5 mm diameter, olive-green, terete, leaf sheaths four, green, flushed brown towards tip, spotted brown below, c. 8 mm long, obtusely pointed at tip; *leaf* erect, c. 5.5 cm long, 1.7 cm wide at widest point, ligulate-lanceolate, tip notched, c. 1 mm deep, base cuneate, glabrous, glossy, dull green above, midrib grooved, paler green underneath, matt, margins purple, venation obscure, fleshy, articulation with pseudobulb flushed purple; *flowers* terminal, c. 8 mm long, solitary, arising from unrolling leaves, *pedicel* c. 6 mm long, rose coloured, *outer tepals* free, directed forwards, c. 4 mm long, 1.5 mm wide, pale yellow, *mentum* obtusely urceolate, c. 5 mm long, 5 mm wide, rose coloured, *inner lateral tepals* c. 7 mm long, linear, yellow, directed forward, *lip* c. 7 mm long including spur (which c. 2 mm long), 2.5 mm wide, yellow, limb ligulate, tip concave, acute, with two lateral wings; *column* c. 5 mm long, white; *pollinia* eight, pale yellow; *ovary* ridged, c. 1 cm long, rose coloured; *fruits* not seen.

Mediocalcar abbreviatum is striking when in flower for the contrasting colours of the mentum and tepals. The habit is, however, rather straggling and unattractive in our specimens. The plants are pot grown in pine bark in an orchid house, and receive no special treatment.

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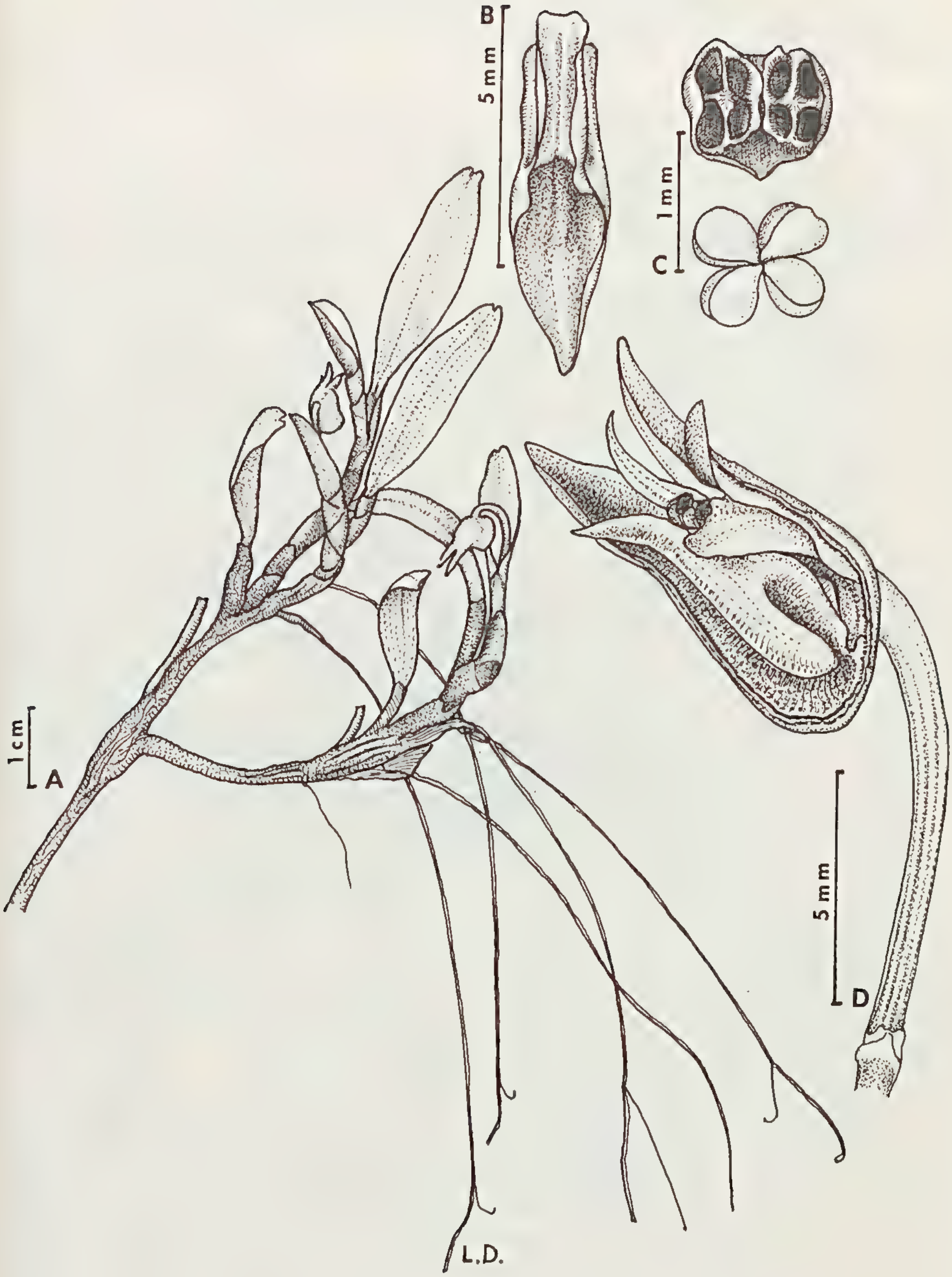


a. flowering plant, b. lip from above, c. pollinia, d. side view of part dissected flower.

7. Craterostigma pumilum Hochst. (Scrophulariaceae)

Craterostigma pumilum Hochst., *Flora,* 670 (1841).

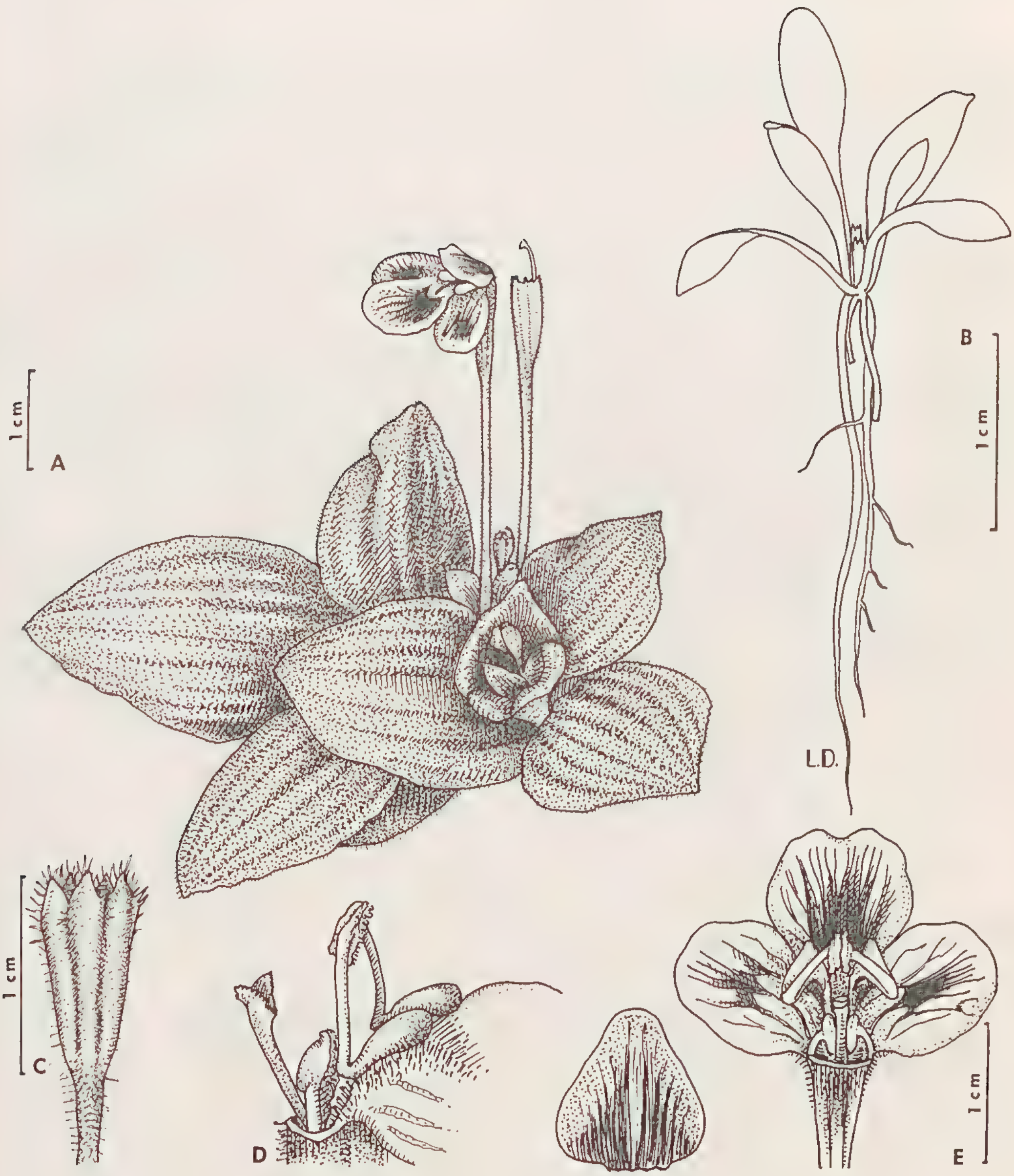
Ic. *The Floral Magazine,* 10: t. 534, (1871), flowering plant in colour; *Trans. Linn. Soc. London* Ser. II Bot. 5: t. 34, 343-55 (1899), diagrammatic studies of all parts including their anatomy.

Synonymy: *Dunalia acaulis* R. Br. in Salt, *Abyss. Append.* 64 (1814), nom. nud.
Torenia pumila (Hochst.) Benth. in DC., *Prod. 10:411(1846)*
Torenia auriculaefolia Dombrain, *Flor. Mag.* 10: t.534 (1871)
Craterostigma auriculaefolium (Dombrain) Benth. & Hook. f. ex Vatke, *Linnaea* 43: 308 (1882).

Flowered Adelaide Botanic Garden on February 2, 1976 accession number 231-73, herbarium voucher AD Herb. Pl. Cult. 6786. Collected from Surud Forest Reserve, northern Somalia by P.R.O. Bally and R. Melville on January 17, 1973, number 16007.

An acaulescent perennial *herb,* c. 4.5 cm tall, dying down in the hot season (personal communication, Melville); *roots* numerous, reddish, succulent, c. 5 cm long and arising from a short rhizome; *leaves* arranged in a rosette, rhombic-ovate, often somewhat oblique, c. 5 cm long, 3 cm wide at widest part, simple, margin crenate and ciliate, tip obtuse, base cuneate into a flattened petiole c. 8 mm wide, lamina dark lustrous green above, glabrous and punctate, veins sunken but obscure, silvery-green beneath, shortly pilose especially on prominent almost parallel longitudinal veins, veins c. 7, subsidiary reticulate venation obscure; *flowers* bisexual, solitary, arising from centre of rosette; *scape* pilose, pedicel c. 4 cm long, green flushed red, subtending bract triangular, c. 5 mm long, ciliate, green; *calyx* c. 9 mm long, five fused lobes each later channelled and connected by hyaline tissue, giving a five-ribbed appearance, green, pilose, free tips of lobes c. 1.5 mm long, ciliate; *corolla* gamopetalous, imbricate in bud, hypogynous, bilabiate, limb obliquely horizontal, *upper lip* oblong-deltoid, 8 mm long, 7 mm wide at base, externally violet with white suffused margins, *lower lip* three-lobed, c. 1.1 cm long, the middle lobe c. 7 mm long, 8 mm wide, internally blotched and veined violet towards mouth of corolla tube, mouth white papillose, the lateral lobes c. 6 mm long, 6 mm wide, internally veined violet in centre, *tube* 9 mm long, cream at base, flushed pale violet towards mouth; *stamens* four, connivent in two pairs, anterior pair each with 2 mm long basal yellow boss decorated with yellow papillae and emerging from mouth of corolla tube, the white filament bases then reflexed into mouth c. 3 mm, then abruptly redirected forward and upward under the internal surface of upper lip of corolla c. 5 mm, *anther* bilocular, opening by longitudinal slits, white, c. 2 mm long, held c. 7 mm beyond mouth of corolla tube, posterior pair held c. 2 mm beyond mouth of corolla tube, filaments c. 1 mm long; *ovary* superior, bilocular, septum in lateral plane, one loculus smaller than the other causing the ovary to appear oblique in insertion, *style* deflected upwards against internal surface of corolla, c. 1 cm long, glabrous, white, *stigmas* two, laminate, papillose, white, held c. 5 mm beyond mouth of corolla tube; *ovules* small and numerous, borne on axile placentation; *fruit* not seen, (*fide* Ward & Dale) cylindric-ovoid, twice as long as calyx which it distends and splits, fruit splitting septicidally; *seeds* not seen, (*fide* Ward & Dale) brown, pitted, numerous with nearly straight embryo.

Craterostigma pumilum has been previously introduced to cultivation, for the Royal Horticultural Society in England awarded a first-class certificate of recommendation to a plant exhibited as *Torenia auriculaefolia* Dombrain by Messrs. Rollisson of Tooting, London on April 5, 1871, (Dombrain, 1871). This material was illustrated in colour in the same publication by Worthington G. Smith, and appears identical with the Adelaide plants. Furthermore, Ward and Dale (1899) published a line drawing of a plant also identical with the Adelaide material, these authors having obtained their plant live in May 1897 at Cambridge Botanic Garden, England from a donation by Mrs. Lort Phillips of material collected in Somaliland. Other Lort Phillips specimens in the herbarium at Kew, Ward and Dale describe as "multi-flowered", which differs from the Adelaide plants and those in the two nineteenth century illustrations.



a. flowering plant, b. rooted offset, c. calyx, d. detail of spatial arrangement of genitalia, e. flower from above with upper corolla lobe removed.

Hemsley and Skan (1906) referred to Lort Phillips material of *C. pumilum* collected from the Wagga Mountains of Somaliland, also noting that it occurs in Ethiopia, Kenya and what is now Tanzania, but it seems that all cultivated material has, or has had apparently solitary flowers. Close inspection of Adelaide material, however, shows that a bract subtends the conspicuous pedicel, and that there is a short peduncle hidden in the rosette of leaves.

Dr. Melville of Kew has kindly identified the collection and noted that it was collected on open ground below a small limestone hill in plateau country, at that time lacking flowers but being assigned to Scrophulariaceae. The wild plants measured about 5 cm tall and in his letter (March 5, 1976) Melville continues, "I didn't realise at the time (of collection) that it is a resurrection plant, that is to say, the rootstock aestivates after the leaves have died down, and all that I saw was the bare stem and the fruit capsules".

Seeds from the Bally and Melville collection are reported to have failed to germinate at Kew, but as seed had also been sent to Adelaide which supplied the plant illustrated here, as well as to the Pacific Botanic Garden in Hawaii, it has been possible to send a live plant to Kew. It is not known whether these are the only plants in cultivation.

The Adelaide material is pot grown in a shaded glasshouse and watered more frequently when leaves and flowers are being produced. Ward and Dale (1899) describe the production of offsets from the axils of the lowermost leaves, the daughter plants, see b, soon developing a rhizome, and the process affording a useful means of propagation in cultivation. The species has not been overwintered in Adelaide outdoors, but trials are to be made once stock is increased. Seed germination is epigeal, and root pigmentation develops soon after, a feature dealt with at length by Ward and Dale.

Dombrain, H.H. (1871). *Torenia auriculaefolia. The Floral Magazine* 10: t. 534.
Hemsley, W. B. & Skan, J. A. (1906). In Thiselton-Dyer, W. T. 'Flora of Tropical Africa' 4(2): 330.
Ward, H. M. & Dale, E. (1899). On *Craterostigma pumilum* Hochst., a rare plant from Somaliland. *Trans. Linn. Soc. Lond.*, Ser. II Bot., 5: 343-355, t. 34-5.

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Adelaide.

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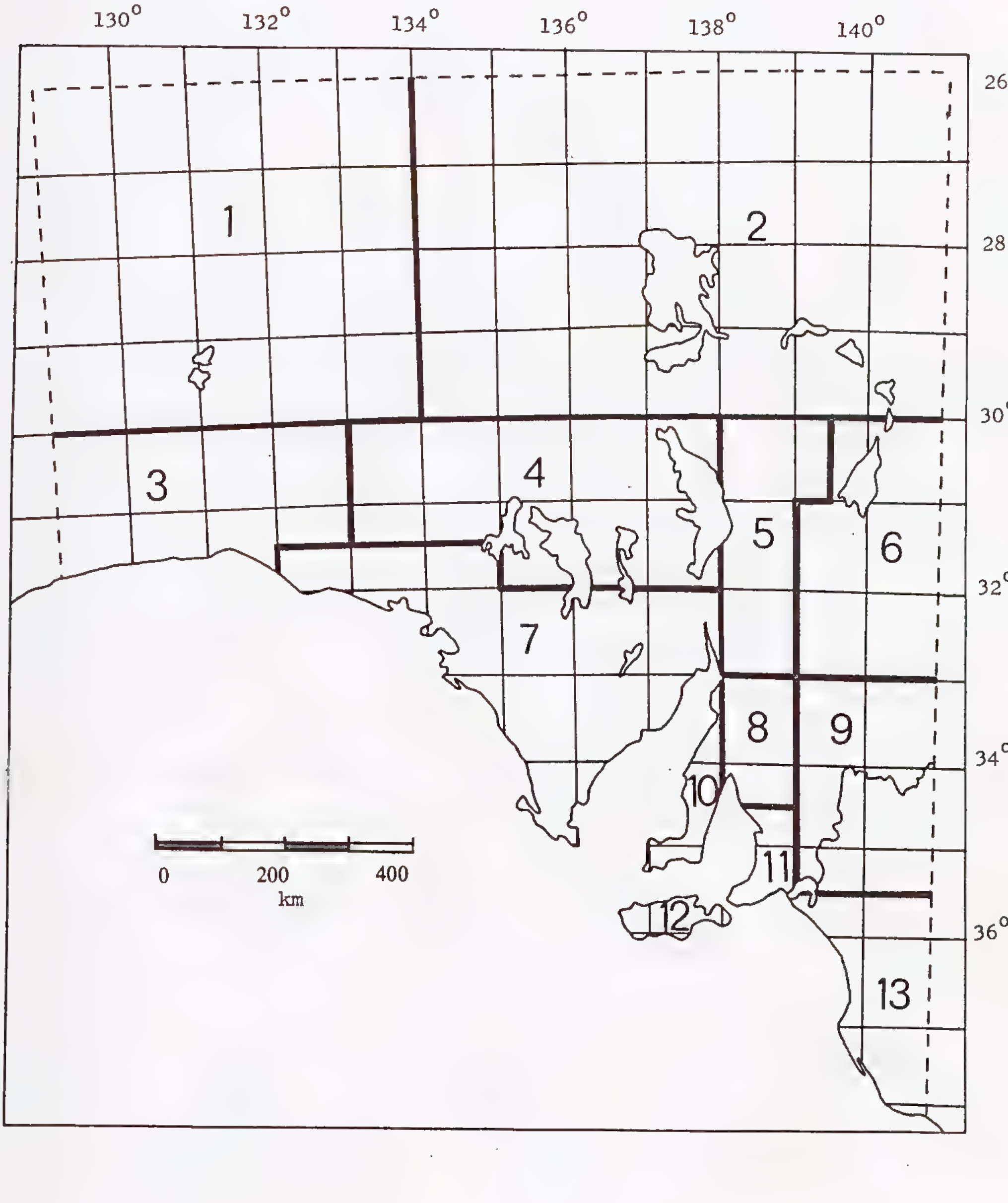
Adelaide.

REGIONS OF SOUTH AUSTRALIA ADOPTED BY THE STATE HERBARIUM — ADELAIDE

1. North-western
2. Lake Eyre Basin
3. Nullarbor
4. Gairdner-Torrens Basin
5. Flinders Ranges
6. Eastern
7. Eyre Peninsula
8. Northern Lofty
9. Murray
10. Yorke Peninsula
11. Southern Lofty
12. Kangaroo Island
13. South-eastern



JOURNAL of the ADELAIDE BOTANIC GARDENS

CONTENTS

JOURNAL of the ADELAIDE BOTANIC GARDENS

Volume 1 Part 3 6 June, 1978

Instructions to Authors

Topics

Papers will be accepted in the following categories:

(a) Plant systematics (Australian and horticultural groups); (b) Descriptive plant morphology, anatomy and ecology; (c) Obituaries, biography and history; (d) Bibliographic studies, book reviews; (e) Botanical illustrations; (f) Noteworthy horticultural contributions.

Copy

Manuscripts must be typed, with double spacing and margins at least 3 cm wide, on one side of the paper only. Three copies must be submitted. Captions must not be italicized, underlined or typed in capitals. All scientific names of generic or lower rank must be underlined.

The print area for illustrations is 20 x 13 cm (including captions). Half-tone material should be submitted this size if possible, but will be reduced by the printers, if necessary.

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Layout

The pattern of the paper should generally be:

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References

Text references to publications should be indicated as follows: (Smith, 1959), (Smith, 1959, p. 127), Smith (1959) or Smith (1959, pp. 125-208). The final section of the paper, headed 'References', should include only those titles referred to in this way. It should be laid out as follows:

Smith, K. L. (1879). The species of *Danthonia* found in pastures in Victoria. *Austral. J. Bot.* 65: 28-53.

Bentham, G. (1868). "Flora Australiensis", Vol. 4. (London: L. Reeve.)

Baker, J. G. (1898). Liliaceae. In Thiselton-Dyer, W. T. (ed.), "Flora of Tropical Africa", Vol. 7 (Ashford: L. Reeve).

Journal abbreviations must be consistent within a paper and authors are recommended to follow "Botanico-Periodicum-Huntianum". Journals not cited in B-P-H should be abbreviated to conform with this general pattern. The following abbreviations for Australian states should be used: WA, NT, SA, Qld, NSW, ACT, Vic., Tas.

Text references to specimens should be italicized, for example *Koch 276.*

Indices

When required, follow the pattern on, for example, p. 106 of vol. 1, pt. 2.

Recommendations on taxonomic papers

Synonymy

Authors are requested to include in the synonymy only references to publications containing information additional to that to be published in the paper being submitted. Within this section journal and book titles must be consistently abbreviated. B-P-H journal abbreviations and book titles abbreviated in a similar way are desirable. Authors of references cited in the synonymy should be abbreviated.

References may be cited as:

Benth., *Fl. Austral.* 4: 111 (1868) OR
Benth., *Fl. Austral.* 4 (1868) 111.

Citation of specimens

10-30 specimens should be cited for each species (or subspecific taxon), although this may be varied under certain circumstances. The author may decide whether or not to include dates of collections and the sequence, provided a constant pattern is adhered to throughout a paper.

Authors wishing to cite all specimens seen may list them all in an index to collectors after the style of the "Flora Malesiana" identification lists. Collections not identifiable by a collection number (assigned by either the collector or herbarium) should cite dates.

Correspondence

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The Director, Adelaide Botanic Gardens, North Terrace, ADELAIDE, South Australia 5000.

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A TAXONOMIC REVISION OF THE GENUS *HEMIPHORA* (CHLOANTHACEAE)

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Adelaide, South Australia 5000

Abstract
A taxonomic revision of the monotypic genus *Hemiphora* is provided. The affinities and distribution are considered and a detailed revised description is provided for the genus and the species. A habit sketch of a flowering branch and analytical drawings of the flowers are also included.

The genus *Hemiphora* was proposed by F. Mueller (1882), with one species, *H. elderi*, the type of which was collected by J. Young in Western Australia. Previously, however, the type specimen had been described by F. Mueller (1876) as a species of *Chloanthes* R.Br., *C. elderi*, with the remark: "In genera propter antherarum duas cassas sectionem seorsam Hemiphora dicendam sistit".

It was referred by F. Mueller (1876) to the Verbenaceae where it has been retained by the majority of botanists. Subsequently, however, Durand (1888) placed the genus in Bentham & Hooker's (1876) tribe Chloantheae in the Verbenaceae. The same tribe was upgraded by Briquet (1895) to a subfamily Chloanthoideae, by Hutchinson (1959) to a family Chloanthaceae and by Airy Shaw (1965) to a new family Dicrastylidaceae. Moldenke (1959) referred the tribe to the family Stilbaceae. In the present revision, however, *Hemiphora* is referred to the tribe Chloantheae in the Chloanthaceae. For details of the taxonomic history of the tribe Chloantheae, see the taxonomic revisions of the related genera *Spartothamnella*, *Chloanthes* and *Cyanostegia* published by the present author (Munir, 1976, 1977, 1978).

HEMIPHORA F. Muell.

(Greek, *hemi*, half; *phorus*, bearing: alluding to its stamens of which half are fertile).

Hemiphora F. Muell., Syst. Cens. Aust. Pl. 1(1882)103 (the type species was initially described as a species of *Chloanthes* by F. Muell., Fragm. Phyt. 10(1876)13); F. Muell., J. Roy. Soc. N.S.W. 15(1882)41; Durand, Gen. Phan. (1888)319; F. Muell., Sec. Syst. Cens. Aust. Pl. (1889)173; Briq. in Engl. & Prantl, Pflanzenfam. 4, 3a(1895)162; Dalla Torre & Harms, Gen. Siphon. (1904)431, no. 7169; Diels & Pritzel, Bot. Jahrb. Syst. 35(1904)496, 524; Post & Kuntze, Lexic. Gen. Phan. (1904)273, 688; Maid., Aust. Veg. (1914)190 in obs.; Gard., Enum. Pl. Aust. Occ. 3(1931)112; Junell, Symb. Bot. Upsal. 4(1934)73; Lemée, Dict. Descrip. Syn. Gen. Pl. Phan. 8b(1943)654; Willis, Dict. Fl. Pl. & Ferns 6 ed. (1957)321; Gard., Wild Fl. W. Aust. (1959)127 in obs.; Mold., Résumé Verben. etc. (1959)404; Burb., Dict. Aust. Pl. Gen. (1963)148; Beard (Ed.), W. Aust. Pl. (1965)92; Blackall & Grieve, W. Aust. Wildfls 3(1965)560; Beard (Ed.), W. Aust. Pl. 2 ed. (1970)113; Morcombe, Aust. Wildfls (1970)94 in obs.; Mold., Fifth Summary Verben. etc. 2(1971)751; Airy Shaw, Willis's Dict. Fl. Pl. & Ferns 8 ed. (1973)546; Erickson et al. (Ed.), Fl. Pl. W. Aust. (1973)138.

Type species: H. elderi (F. Muell.) F. Muell., Sec. Syst. Cens. Aust. Pl. 1(1882)103.
Chloanthes F. Muell., Fragm. Phyt. 10(1876)13 p.p. quoad. sp. *C. elderi*.

Description

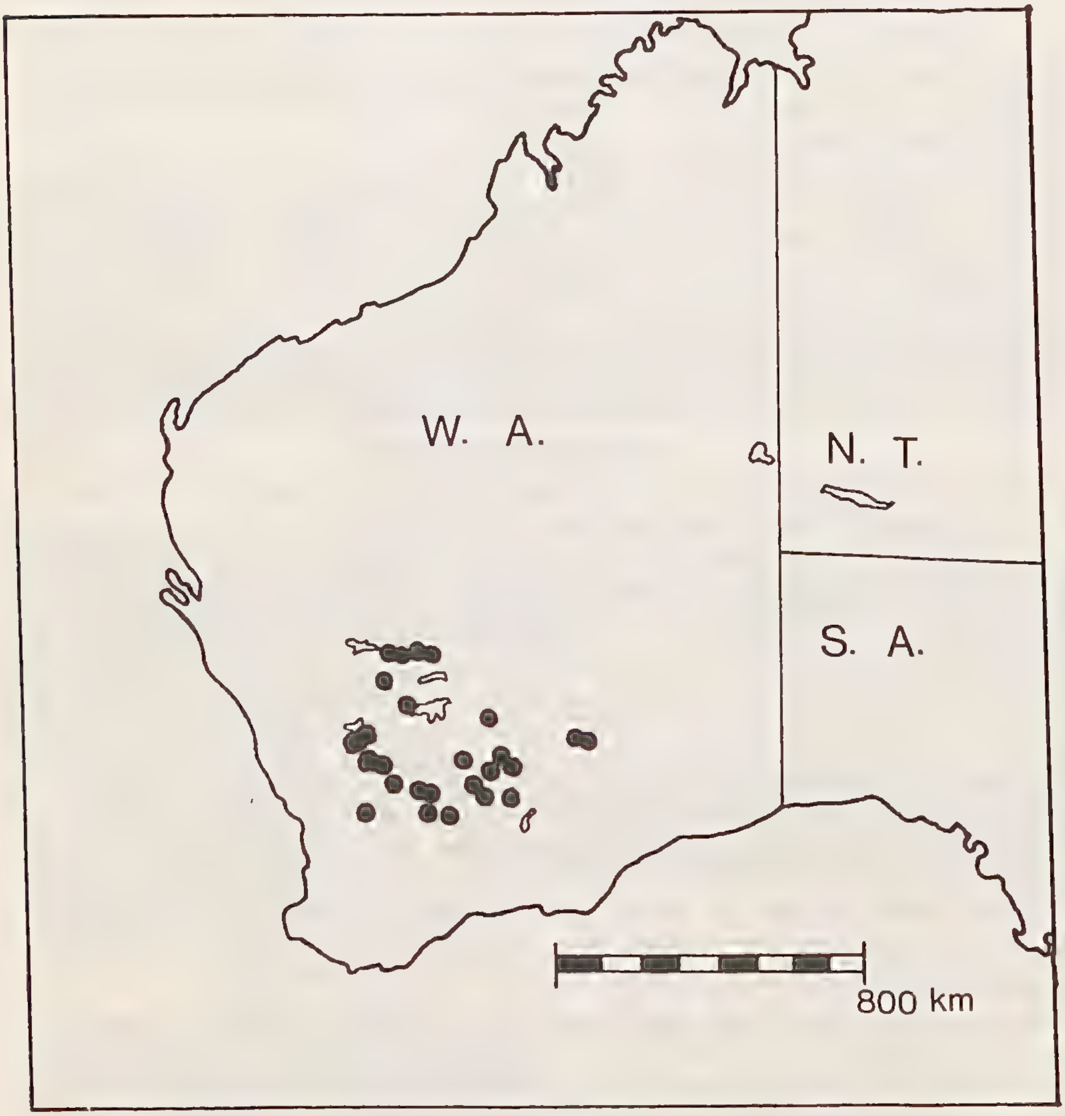
Perennial shrubs, densely clothed with branched woolly tomentum. *Stem* erect, branched, cylindrical, solid and woody. *Leaves* cauline and ramal, exstipulate, simple, sessile, reticulate unicostate, decussate or in whorls of 3, bullate-rugose, non-decurrent. *Flowers* axillary, solitary, bracteate, with two lateral bracteoles, complete, zygomorphic, bisexual, hypogynous. *Calyx* of 5 fused sepals, persistent, deeply 5-lobed, tubular below. *Corolla* of 5 fused petals, caducous, 2-lipped, tubular below, the upper-lip 2-lobed, the lower

lip 3-lobed; lobes almost identical; tube elongated, curved and dilated upwards. *Stamens* 4, only the 2 upper fertile, epipetalous, inserted below the middle of the corolla-tube; filaments filiform, glabrous; anthers dorsifixed, 2-lobed; lobes free in the lower halves, without any appendages at the lower end, longitudinally dehiscent. *Ovary* bicarpellary, syncarpous, 4-locular with one axile ovule in each cell; style filiform, glabrous, 2-lobed at the summit. *Fruit* non-dehiscent, dry. *Seeds* albuminous.

Number of Species: 1.

Distribution (Map 1)

The genus *Hemiphora* is endemic in Western Australia.



Map 1. Distribution of *Hemiphora elderi* (F. Muell.) F. Muell.

Affinities

Hemiphora is closely related to *Chloanthes* R.Br. in having branched tomentum all over the plant, rugose-bullate leaves with recurved margins, axillary solitary flowers towards the end of branches, non-accrescent fruiting calyx, 2-lipped corolla and no appendages to the anther-lobes. Nevertheless, *Chloanthes* can be distinguished easily by having decurrent leaves and 4 fertile stamens.

Hemiphora is also close to *Pityrodia* R.Br. in having non-decurrent leaves, 2-lipped corolla, and stamens inserted in the lower half of the corolla-tube. However, *Pityrodia* R.Br. may be identified readily by having 4 fertile stamens and appendaged anther-lobes.

Hemiphora elderi (F. Muell.) F. Muell., Syst. Cens. Aust. Pl. 1(1882)103; F. Muell., Sec. Syst. Cens. Aust. Pl. 1(1889)173; Briq. in Engl. & Prantl, Pflanzenfam. 4, 3a(1895)162 in obs.; F. Muell. & Tate, Trans. Roy. Soc. S. Aust. 16(1896)376; Diels & Pritzel, Bot. Jahrb. Syst. 35(1904)524; Ewart & Davies, Fl. N. Terr. (1917)239 in obs.; Gard., Enum. Pl. Aust. Occ. 3(1931)112; Junell, Symb. Bot. Upsal. 4(1934)73, fig. 123; Gard., Wildfls W. Aust. (1959)132; Mold., Résumé Verben. etc. (1959)209,251; Beard (Ed.), W. Aust. Pl. 1 ed. (1965)92; Blackall & Grieve, W. Aust. Wildfls 3(1965)573, t. 29 p.p.; Beard (Ed.), W. Aust. Pl. 2 ed. (1970)113; Mold., Fifth Summary Verben. etc. 1(1971)346, 425; Erickson et al., Fl. Pl. W. Aust. (1973)138, 196 and t. 431.

Type: J. Young s.n., near Victoria Springs, Western Australia, 7-9 Oct., 1875(MEL 73286 lectotype; MEL 73287 syntype).

Chloanthes elderi F. Muell., Fragm. Phyt. Aust. 10(1876)13 — **Basionym.**

Typification

H. elderi was based on two specimens collected by J. Young in Western Australia. One of these with yellow floral-tomentum was gathered from near Ularing and the other with red floral-tomentum came from near the Victoria Springs. Both the syntypes are preserved in Herb. MEL and are labelled erroneously as "Isotypes". Of these, the one with red floral-tomentum collected from near the Victoria Springs and now preserved under the number MEL 73286, is particularly complete and well preserved and is therefore selected here as the lectotype for this species.

Description (Fig. 1)

A shrub 30-45 cm high. *Stem* often with several branches arising from a common stock. *Leaves* pale green, linear, linear-lanceolate or almost terete owing to the revolute margins, densely white woolly all over, (7-)10-15(-20) mm long, (2-)3-4(-5) mm broad at the base, rugose-bullate above, the woolly under surface often concealed by the revolute margins; bullae tuberculate or muricate. *Flowers* collected into short leafy spike-like clusters near the summit of the branches, shortly pedicellate; pedicel 1-2 mm long, densely hairy; bracts leafy, sessile, linear, linear-lanceolate or narrowly elliptic-oblong, with revolute margins,(5-)7-9(-10) mm long, 2-4(-5) mm broad, rugose along the margins, woolly-tomentose underneath and on the rugose margins, glabrous above; bracteoles sessile, oblong or more or less linear, 3-4 mm long, 1-1.5 mm broad, woolly-tomentose underneath, glabrous above. *Calyx* deeply 5-lobed, with a very short tube, (6-)8-10 mm long, densely clothed outside with branched woolly tomentum of reddish-purple or claret colour, glabrous inside excepting the few sparse hairs on the upper inner half of the lobes; lobes almost free to the base, linear or oblong-linear, (6-)7-9 mm long, 0.5-1 mm broad; tube 0.5-1 mm long. *Corolla* reddish-purple, claret-coloured or occasionally yellow, (14-)15-22(-25) mm long, pubescent outside, glabrous inside excepting the dense hairy ring above the ovary, and with a few hairs extending to the anterior (i.e. lower) lip; the upper-lip longer than the lower one, 5-7 mm long, 6-8 mm broad; lobes oblong-ovate or more or less deltoid, (3-)4-5 mm long, 3-4(-5) mm broad at the base; tube almost cylindrical towards the base, dilated immediately above the calyx, (8-)10-15 mm long, (6-)7-9 mm in diameter in the upper half. *Stamens* 4; the

Fig. 1. *Hemiphora elderi* (F. Muell.) F. Muell. (*R. Helms s.n.*, AD97113280: AD). A, habit drawing; B, flower with bract and bracteoles; C, flower with calyx and corolla vertically cut open to show androecium and gynoecium; D, transverse section of ovary; E, ovary; F, fruit; G, calyx-tomentum; H&I, adaxial and abaxial views of an enlarged leaf portion.

2 upper stamens fertile, exserted, filaments (10-)12-15 mm long, anthers ca. 2 mm long, ca. 1 mm broad, lobes free in the lower halves, not divergent; the 2 lower stamens sterile, included, filaments 6-8 mm long, anthers shrivelled, ca. 1 mm long, ca. 0.5 mm broad, lobes free and divergent in the lower halves. *Ovary* more or less globose, 1-2 mm in diameter, glabrous in the lower half, pubescent above; style scarcely exserted or almost included, filiform, glabrous, 17-20(-22) mm long, minutely 2-lobed at the summit. *Fruit* more or less globose, 2.5-3 mm in diameter, pubescent.

Specimens examined

WESTERN AUSTRALIA: *Ashby 3607,* north of Beacon, 17.IX.1970 (AD, PERTH). *Barrett 15,* Ghooli, no. 6 Pumping Stn, 3.X.1952 (PERTH). *Beard 4724,* 8 miles N. of Wialki, 16.VII.1967 (PERTH). *Blackall 478,* between Sandstone and Anketell, 16.VIII.1931 (PERTH). *Blackall 3343,* near Mt. Churchman, Sept. 1937 (PERTH). *Blackall s.n.,* 25 miles N. of Beacon, Oct. 1937 (PERTH). *Broadbent 1723,* 12 miles west of Sandstone, 12.X.1953 (BM). *Campbell s.n.,* Boulder, near Kalgoorlie, 1899 (BM, C, PERTH). *Cleland s.n.,* Kurrawang, Sept. 1915 (AD). *Cook s.n.,* between Bonnie Rock and Wialki, Nov. 1932 (PERTH). *Cronin s.n.,* Coolgardie, near Lake Lefroy, 1893 (MEL 73291). *Cronin s.n.,* (between upper Blackwood River and Lake Lefroy, 1893 (MEL 73292). *Davies for A.M. Ashby no. 2058,* north of Menzies, Sept. 1966 (AD). *Demarz 5114,* 16 miles west of Sandstone, 21.VIII.1974 (King's Park Perth). *Erickson s.n.,* western fringes of Southern Cross, July 1952 (MEL 73295). *Fairall 2400,* 28 miles west of Coolgardie, 13.X.1967 (PERTH). *Fairall 8802,* 38 miles east of Sandstone on road to Leonora, 13.IX.1966 (MEL). *George 8009,* 18 miles E. of Sandstone, 13.IX.1966 (PERTH). *George 8043,* S.W. of Queen Victoria Rocks, 16.IX.1966 (B. MO, PERTH). *Gardner 541,* Kalgoorlie, Sept. 1922 (PERTH). *Gardner 966a,* N. of Southern Cross, Oct. 1922 (PERTH). *?Gardner 1215,* Comet Vale, Sept. 1959 (PERTH). *Gardner & Kretchmar 12704,* Beacon, 4.IX.1960 (PERTH). *Gardner 2509,* 18 miles W. of Sandstone. 18.VIII.1931 (PERTH). *Gardner 7958,* Comet Vale. 19.X.1945 (PERTH). *Gardner 14377,* near Youanmi, 26.VIII.1963 (PERTH). *Gardner 19026,* N. of Lake Barlee, 19.X.1966 (PERTH). *Gardner s.n.,*N. of Southern Cross, Nov. 1923 (PERTH). *Gardner s.n.,* near Ghooli, Oct. 1953 (PERTH). *Gardner s.n.,* near Menzies, November — ((PERTH). *Gardner s.n.,* Sandstone, undated (PERTH). *Hann s.n.,*80 miles N.E. from Southern Cross, Oct. 1901 (K, PERTH). *Helms s.n.,* Victoria Desert, Eld. Expl. Exped. Camp 58, C. 195 km east of Kalgoorlie, 21.IX.1891 (AD96215330, AD 97113280, AD 97113290-1, AD 97709161, K, MEL 73288-9, NSW 129474-7, WU). *Hill 1446,* west of Kalgoorlie, 9.X.1964 (AD). *Hunter 5047,* between Warralakin and Bullfinch, Aug. 1967 (King's Park Perth). *Merrall s.n.,* Parker's Range, 1892 (MEL 73290). *Main s.n.,* Bonnie Rock — Wialki, 11.IX.1957 (PERTH). *F. Mueller s.n.,* Victoria Springs, undated (W 736-7, WU). *Newman s.n.,* Bullfinch, 10.XI.1922 (PERTH). *Richardson s.n.,* Mukinbudin, Nov. 1929 (PERTH). *Richmond R 48,* loc. incert., Oct. 1972 (PERTH). *Royce 10443,* N. of Sandstone, between Wiluna and Meekathara, 16.X.1972 (PERTH). *Thiselton-Dyer 116,* along railway between Conderdin and Wedari (or ?Dedari), Oct. 1903 (K). *Stacey 237,* 12.6 miles E. of Mukinbudin, 16.XI.1972 (PERTH). *Webster 18,* Coolgardie, 1898 (G, MEL). *Wilcox S.164.* F. Ayres' property, Cleary Siding, Bonnie Rock, 25.XI.1966 (King's Park Perth, PERTH). *Young s.n.,* "Ad scatturigines Victoria Springs", between Victoria Springs and Ularing, 7-9 Oct. 1875 (MEL 73286 *lectotype). Young s.n.,* "Prope Ularing", between Victoria Springs and Ularing, 7-9 Oct. 1875 (MEL 73287 *syntype).*

Distribution (Map 1)

H. elderi is endemic in the south-west of Western Australia. The main areas of its occurrence are in the Austin and Coolgardie districts (as defined by Gardner & Bennetts, 1956) of the Eremean Province where it seems to be restricted between latitude 27° and 32° S, and between longitude 117° and 124° E. In the north it is known from around Sandstone and Menzies, extending southwards to the Parker Range and the upper sources of the Blackwood River. Elsewhere, the distribution extends from south-west of Lake Moore and the township of Cunderdin in the west up to the Victoria Springs in the east.

Comments

Neither of the two specimens in the type folder at Herb. K is the type. One of these was collected by G.H. Thiselton-Dyer (Coll. no. 116) in 1903, and the other by R. Helms (s.n.) in 1891, during the Elder Exploring Expedition. Both the specimens were gathered many years after the publication of this species.

According to Ewart & Davies (1917), *Hemiphora elderi* was recorded from Northern Australia in the "Nation Herbarium Census". During the present investigations, however, *Hemiphora* has been found to be restricted to the south-west of Western Australia.

The fruit is small and concealed within the long dense woolly tomentum of the persistent calyx. This may have been the reason why botanists, including the original author (F. Mueller), failed to describe it.

Due to the usually brilliant-red colour of the woolly inflorescence, Erickson et al. (1973) have called this species "red velvet".

Two specimens collected by C. L. Webster are recorded here. One of them in Herb. G is without collector's number and the other in Herb. MEL is with collector's field note and no. "18". Since both the specimens come from the same locality and bear the same collecting date (only year is given) they are treated here as belonging to the same collection.

Acknowledgements

The author wishes to thank Dr J.P. Jessop for his comments on the manuscript; Mr L. Dutkiewicz for preparing the illustrations; and Miss M. Eadsforth for typing the manuscript.

Thanks are also due to the Directors / Curators of the following institutions for the loan of herbarium specimens: B, BM, C, G, GH, K, King's Park Perth, MEL, MO, NSW, PERTH, W, WU.

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J. Adelaide Bot. Gard. 1(3): 167-169 (1978) a 224833

A NEW SPECIES OF *PRASOPHYLLUM* (ORCHIDACEAE) FROM SOUTH AUSTRALIA

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Abstract

Prasophyllum goldsackii, sp. nov., is described from Eyre and Yorke Peninsulas, South Australia. It appears to be close to *P. fitzgeraldii* R.S. Rogers & Maiden.

Prasophyllum goldsackii J.Z. Weber & R. Bates, sp. nov.

Herba terrestris, 10-30 cm alta, glabra, tubere globoso, caule basi vaginis fibrosis vestito. *Folium* racemum superans, angustum, conduplicatum, 1-2 mm latum, viride; fistula caulis medium ultra. Racemus laxus, constans ex 5-12 floribus; bractea ovata, acuta, circa 2 mm longa lataque; *flores* breviter pedicellati, erecto-patentes, atropurpurei, cleistogami; *ovarium* viride, breve, turgidum, 4-7 mm longum, 2-3 mm latum. *Sepalum* dorsale ovatum, acutum, decurvum, 3-4 mm longum, circa 2.5 mm latum, concavum, viride, apicem versus purpureum; sepala lateralia demum distincta, 4-5 mm longa, circa 1.5 mm lata, falcata, incurvata, viridia, apice cum stria media purpureo. *Petala* triangularia, acuta, circa 3 mm longa et 1.5 mm lata, viridia, apicem versus purpurea, interdum sepalibus omnino occulta. *Labellum* triangulare, subacutum, circa 4 mm longum, basi 1.5-2 mm latum, recurvum, distaliter carinatum, apice inflexum, viride, marginibus apiceque pallido-pruninis; callobractea virida, basi concava, distaliter spissescens atque elevata, ad flexum in duabus cristis prominentibus abrupte terminata; marginibus integris, vix undulatis. *Columna* brevis, erecta, circa 1.7 mm longa et 1.5 mm lata; appendices erectae, lanceolatae, apicibus obtusis, rostellum brevioribus; stigma obcordata; anthera triangularis, circa 1.2 mm alta, *pollinia* duo, granularia; caudicula brevis. (Fig. 1.)

Holotype: *H. Goldsack 611,* 10.x.1954, Corny Point (34°54'S, 137°01'E) South Australia. (AD 97708491).

Herb terrestrial, 10-30 cm high, glabrous; arising from a globose tuber; the base of stem invested in fibrous sheaths. *Leaf* longer than raceme, narrow, conduplicate, 1-2 mm wide, green; sheathing above the middle of the stem. Raceme loose, 5-12 flowered, *flowers* shortly stalked, subtended by ovate, acute bracts about 2 mm long and wide, spreading, dark-purple, cleistogamous; *ovary* green, short, turgid, 4-7 mm long and 2-3 mm wide. Dorsal *sepal* ovate, acute, hooded, decurved apically, 3-4 mm long and 2.5 mm wide, green, purple towards apex; lateral sepals eventually free, 4-5 mm long and c. 1.5 mm wide, falcate, incurved, green with purple central stripe and apex. *Petals* triangular, acute, c. 3 mm long and c. 1.5 mm wide, green and purple towards apex, sometimes completely hidden by sepals. *Labellum* triangular, subacute, c. 4 mm long and 1.5-2 mm wide at the base, recurved and keeled distally with inflexed apex, green with pale prune-coloured edges and apex; callus-plate green, concave at base, increasingly thickened and convex distally, terminating as two prominent ridges in the bend of labellum, margins entire, slightly undulate. *Column* short, erect, c. 1.7 mm long and c. 1.5 mm wide; appendages erect, lanceolate with obtuse tips, shorter than rostellum, basally adnate to stigmatic plate; stigma obcordate; anther triangular, c. 1.2 mm long, *pollinia* two, granular and friable, easily removed; caudicle short. Seed small, oblong, c. 0.2 x 0.1 mm, numerous, cream-white.

Fig. 1. *Prasophyllum goldsackii*, plant ½ nat. size; 2. inflorescence; 3. flower from the front; 4. flower from side; 5. dorsal sepal; 6. lateral sepals connate; 7. lateral sepals free; 8. petals; 9. labellum from the top showing callus-plates; 10. labellum from side; 11. column from front showing appendages; 12. anther; 13. stigma and rostellum; 14. pollinia with caudicle; (drawings made from cultivated specimen originating from Yorke Peninsula.)

Flowers have been collected in October, and the species is apparently endemic in South Australia, confined to Eyre and Yorke Peninsulas.

Specimens examined

Eyre Peninsula: *M.G. Clark s.n.*, Hundred of Koppio (34°26'S, 135°52'E) (AD). Yorke Peninsula: *H. Goldsack s.n.*, 12.x.1953, Corny Point (AD); *R. Bates 121*, 7.x.1973, Warranbeen National Park (33°10'S, 137°10'E) (AD); *R. Bates 692*, 10.x.1974, c. 10 km south of Moonta (34°09'S, 137°38'E) (AD).

P. goldsackii is reported by R. Bates to have been abundant on Yorke Peninsula in hard terra rossa limestone country, most of which is now under cultivation. It has presumably been overlooked by collectors in the past, because the flowers seldom open and appear withered even in early bud.

It has most similarities with *P. fitzgeraldii* R.S. Rogers & Maiden as regards the labellum but differs in the triangular, acute petals, the decurved dorsal sepal, the callus-plate terminating abruptly in two ridges well short of the tip of the labellum and the dark flowers. *P. fitzgeraldii* differs in having blunt linear petals, an incurved dorsal sepal, a triangular callus-plate reaching near the tip of the labellum, and usually more than ten flowers per raceme, fully open and fragrant. The flowers of *P. goldsackii* do occasionally open in hot weather, but probably only after self-pollination has occurred.

A key to the South Australian species of *Prasophyllum* has been prepared by the authors and will appear in the third edition of J.M. Black's 'Flora of South Australia'.

Acknowledgements

Mr J. Carrick's assistance with the Latin translation is greatly appreciated. Mr L. Dutkiewicz prepared the illustration.

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a 224834

EREMOPHILA LINSMITHII, A NEW SPECIES OF MYOPORACEAE FROM QUEENSLAND

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Abstract

A new species of *Eremophila* is described from Queensland. *E. linsmithii* R.J. Henderson, sp. nov., belongs to section *Amphichilus* and is related to *E. gibsonii* and *E. gilesii*.

An account of the species of *Eremophila* R.Br. from Queensland by L.S. Smith has recently been published posthumously (Smith, 1975). At the time of his death (1970), Smith considered his treatment of the genus incomplete and not worthy of publication at that stage. He had not accounted for at least one undescribed species he recognized from herbarium material and plants in the field.

In editing his manuscript for publication, I refrained from inserting additional material such as the description of a new species, so that the treatment when published, would be solely his.

In his honour, I now formally describe the species, material of which was segregated by Smith in the Queensland Herbarium. The species is that referred to in my footnote on page 12 of the above account.

Eremophila (Amphichilus) linsmithii R.J. Henderson, sp. nov. aff. *E. gilesii* F. Muell. sed floribus lilacinis pallidis ad fere albis, lobis corollae adaxialibus duobus ± connatibus omnino, ovario glabro sed minute papilloso, fructu calyce conspicue breviori differt. Typus — 30 miles S.E. of Quilpie, 9 Sep. 1967. *Pedley 2452* (holotypus BRI 094002; isotypi distribuendi K, CANB, AD, NSW).

Frutex erectus ± turbinatus, c.0.5-1.75 m altus, ramosus prope basin; rami ascendentes vel patentes. *Ramuli* sub-glabri pilis minutis dispersis brevibus simplicibus curvis, conspicue viscidi. *Folia* alternata lineares plana, usque ad 6.5 cm longa et 1-3 mm lata, glabra ad sub-glabra pilis minutis dispersis brevissimibus simplicibus curvis, viscida, ad apicem acuta vel obtusa sed extremun ± breviter apiculata, basin versus attenuata petiolis brevibus. *Flores* solitarii, axillares, viscidi praecipue in alabastro; pedicelli ± sigmoidei, recti vel ascendentes, viscidi, sub-glabri pilis brevissimibus simplicibus curvis; pili infra dispersi sed ± densiores subter calycem. *Calyx* ad basim in 5 segmentia imbricata fere divisus; segmenta glabra praeter pilos aliquot breves simplices vel 1- furcatos in marginibus, papillis minutis densis utrinque obtecta, ovata ad anguste ovata vel obovata, acuta ad acuminata, 0.7-1.2 cm longa et 3-5.5 mm lata, crustacescentia et reticulatim nervatescentia, pallide-brunnescentia et usque ad 1.5 cm longa et 8 mm lata subter fructus. *Corolla* lilacina pallida ad fere albida, extrinsecus maxime sparsim pubescens, intra in partibus mediis et infernis loborum adaxialium et lobi abaxialis medii et tubum floccosa: lobi 5, dispares; par adaxiale connatum formans lobum singularem ± semicircularem reflexum apice apiculato vel minute emarginato, 1-1.2 cm longum et 1.2-1.5 cm latum; lobi laterales oblique oblongi ad anguste ovati, acuti, 0.7-1.3 cm longi et 3.5-5.5 mm lati; lobus abaxialis semi-ellipticus obtusus apice breviter apiculatus vel truncatus et minute emarginatus, longistrorsum ± plicatus (± semicircularis in sectione), 0.7-0.9 cm longus et 5-6.5 mm latus. *Stamina* inclusa; fila ± pubescentia, in paginis interioris infernis floccosa; par infernum c.7.5-10 mm longum, par supernum c.11-13 mm longum; antherae reniformes, c.2.75-3.5 mm latae; pollen ± globosum, 24-29 μm latum. *Ovarium* glabrum sed minute papillosum papillis densioribus in 2/3 supero, cylindricum breve, truncatum, 4-5 mm longum et 1.5 mm latum, 2- loculatum ovulis 6-8 in quoque loculo; stylus filamentosus, 1-1.5 cm longus, sparsim pubescens. *Drupa* (exsiccata) ampulliformis, glabra sed papillis dispersis, viscida, c.7 mm longa et 5 mm lata,

longistrorsum nervosa, 4-loculata seminibus 2-3 in quoque loculo. Semina matura non vidi. Chromosomatum numerus 2n=36 (BRI 225898; BRI 225899).

E. linsmithii sect. *Amphichili* (DC.) L.S. Smith pertinet.

An erect ± turbinate *shrub* about 0.5-1.75 m high, branched from near the base, the branches ascending or spreading. *Branchlets* sub-glabrous with scattered short simple curved hairs, conspicuously viscid. *Leaves* alternate, linear, flattened, up to 5 cm long and 1-3 mm wide, glabrous to sub-glabrous with scattered very short simple curved hairs, viscid, towards the tip acute or obtuse but ultimately ± shortly apiculate, towards the base tapered to the very short petiole. *Flowers* solitary, axillary, viscid particularly in bud; pedicels ± sigmoid, erect or ascending, viscid, sub-glabrous with very short curved simple hairs; hairs scattered below but somewhat denser beneath the calyx. *Calyx* divided almost to the base into 5 ± equal imbricate segments; segments glabrous except for a few short simple or once bifurcate hairs on the margins, covered on both surfaces with dense, minute papillae, ovate to narrowly ovate or obovate, acute to acuminate, 0.7-1.2 cm long and 3-5.5 mm broad, becoming ± crustaceous and reticulately veined, pale brown and up to 1.5 cm long and 8 mm wide under the fruit. *Corolla* pale lilac to almost white, very sparsely pubescent outside, inside floccose on the mid and lower portions of the adaxial lobes and the central abaxial lobe and in the tube: tube 1.2-1.4 cm long: lobes 5, unequal; adaxial pair fused to form a single ± semicircular reflexed lobe with an apiculate or minutely notched tip, 1-1.2 cm long and 1.2-1.5 cm across; lateral lobes obliquely oblong to narrowly-ovate, acute, 0.7-1.3 cm long and 3.5-5.5 mm wide; abaxial lobe semi-elliptic, obtuse with a short apiculate tip or truncate and minutely emarginate, longitudinally folded (± semi-circular in cross-section), 7-9 mm long and 5-6.5 mm across. *Stamens* included; filaments ± pubescent, floccose on the lower inner surfaces; lower pair c.7.5-10 mm long, upper pair c.11-13 mm long; anthers reniform, c.2.75 mm wide; pollen ± spherical, 24-29µm across. *Ovary* glabrous but minutely papillose with papillae more dense in the upper 2/3, shortly cylindrical, truncate, 4-5 mm long and 1.5 mm across, 2-celled with 6-8 ovules in each cell; style filamentous, 1-1.5 cm long, sparsely pubescent. *Drupe* (when dried) ampulliform, glabrous, with scattered papillae, viscid, c.7 mm long and 5 mm wide, longitudinally ribbed, 4-celled with 2-3 seeds in each cell. Mature seed not seen. Chromosome number 2n=36. (Fig. 1.)

E. linsmithii belongs to sect. *Amphichilus* (DC.) L.S. Smith.

Specimens examined

WARREGO DISTRICT: Quilpie, Oct. 1948, *G.W. Althofer 34;* Quilpie, Nov. 1952, *D.M. Gordon 117;* 30 miles SE of Quilpie, on brown loam with *Dodonaea adenophora, Cassia* spp. and *Acacia microsperma,* 9 Sep. 1967, *L. Pedley 2452,* 31 Aug. 1977, *R.J. Henderson H2513, H2514;* 27°09'S, 144°25'E, c. 10 km NNE of Toompine (62 km S of Quilpie), 20 Aug. 1976, *R.E. Isaacson 17.* GREGORY SOUTH DISTRICT: Pinkilla Ridge. [Grey Range] Quilpie to Thylungra road, 27 Nov. 1952, *D.M. Gordon 4,* 31 Aug. 1977, *R.J. Henderson H2517;* ca. 51 miles W of Adavale, brown clay loam with mulga [*Acacia aneura*], 9 Sep. 1960, *S.L. Everist 6251.* CULTIVATED: Cultivated at "Myall Grove", Glenmorgan, from seed collected at Pinkilla Ridge by D.M. Gordon, 4 Apr. 1960, *L.S. Smith 10978.*

This species occurs over a wide area of south-west Queensland on remnants of dissected residuals locally known as "Jump-ups" or "Break-aways". Plants are not widely distributed in any one locality, but may form dense narrow stands extending for some distance along drainage lines where there is a comparatively better class of soil and a higher supply of moisture than on adjacent flats and ridges. The species may extend into the north-western areas of New South Wales.

It has been in cultivation at "Myall Grove" Station in the western Darling Downs district and in Adelaide, South Australia according to R.J. Chinnock of the Adelaide Herbarium.

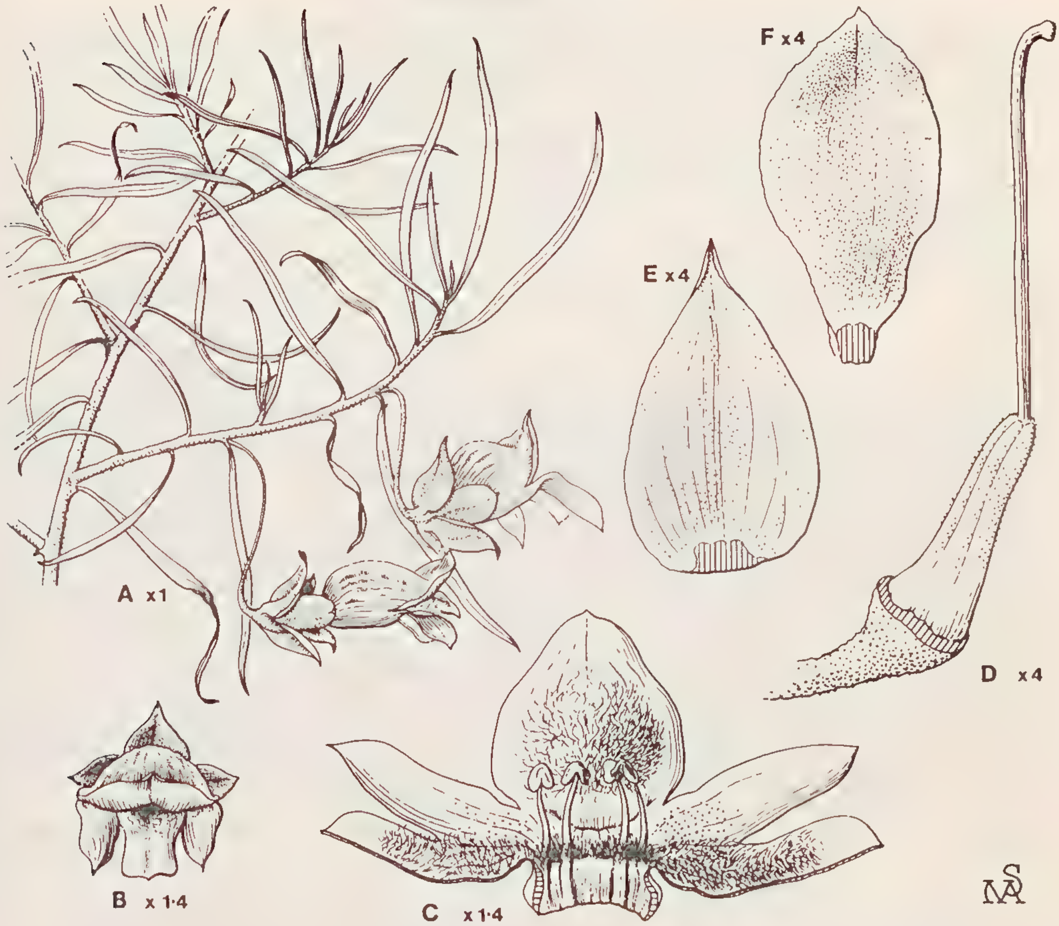

Fig. 1. *Eremophila linsmithii* R.J. Henderson. A, portion of a terminal flowering twig; B, flower looking into throat; C, corolla opened along the middle of the central abaxial lobe to show zones of floccose hairs and stamens; D. gynoecium with corolla and calyx segments removed; E and F, extremes in shape of calyx segments; E, an outer segment; F, an inner segment.

Though the species is most like *E. gilesii* F. Muell. in floral characteristics, it is clearly distinguished from it by the pale lilac to almost white flowers, the upper pair of corolla lobes fused almost completely, the glabrous but minutely papillose ovary and the fruit noticeably shorter than calyx lobes which are ovate rather than lanceolate or narrowly lanceolate. Because of their habit of growth plants may be mistaken for small plants of *E. mitchellii* Benth. in the absence of flowers.

E. linsmithii is closely related to *E. gibsonii* F. Muell., a species described from Central Australia but which also occurs in South Australia and Western Australia. From the little material available to me it apparently differs from *E. linsmithii* principally in the minutely serrulate (not entire) leaves, in the presence of sparse to moderately dense multicellular hairs and small stipitate glands on the calyces and outer surfaces of the corolla, and in the stiffly hairy and glandular (not minutely papillose) ovary.

Chromosome numbers were determined in two plants represented by *Henderson H2513* and *Henderson H2514*. The voucher sheets are BRI 225898 and BRI 225899 respectively.

Acknowledgements

I am grateful to Mr R. Chinnock, Adelaide Botanic Gardens, and Mr G. Needham for supply of fresh material for the illustrator and to Mrs Margaret Saul for preparing the illustration. Mr L. Pedley kindly checked by Latin description.

Reference

Smith, L.S. (1975). The Genus *Eremophila* (Myoporaceae) in Queensland with notes on the genus *Myoporum*. *Contr. Qd Herb.* 19:1-49.

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a 224835

TWO NEW SPECIES OF *CYCAS* FROM NORTHERN AUSTRALIA

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Abstract

Two new species of *Cycas*, namely *Cycas calcicola* and *C. pruinosa*, are described from the Northern Territory and Western Australia respectively. These species are allied to *C. revoluta* Thunb. of Japan and *C. cairnsiana* F. Muell. of Queensland; all four species have pinnae with a distinctly revolute margin.

1. Cycas calcicola Maconochie, sp. nov.

Frutex habitu palmae ad 3 m altus, caudice 17-30 cm diam. Frondes atrovirides, in sectione transversali applanata vel arcuata 60-115 cm (plerumque 80-90 cm) longa, 9-27 cm (plerumque 15-20 cm) lata. *Pinnae* 150-300 (plerumque 220-280) lineares rectae vel leviter curvatae, apice attenuatae ad mucronatae spina terminali c. 1 mm longa, margine revolutae, basi non decurrentes, 8-12 cm longae, 2.5-3 cm (interdum 4 mm) latae, supra glabrae vel pubescentes, infra tantum ad canales pubescentes. *Rhachis* prope basin teres ad tetragona, c. 10 mm lata, basi 8 mm crassa sed prope apicem 2 mm crassa, glabra ad furfuracea ferrugineaque. *Conus masculinus* anguste ovoideus, 17-26 cm longus, 5-6 cm latus; microsporophyllum deltoideum, 15-25 mm longum, basi 5 mm latum, ad apicem 12 mm latum, parte terminali 6-10 mm longa, cinereo-pubescentii apice uncato. *Megasporophyllum* ferrugineum, ad 15 cm longum, apice sterili elliptico-rhombeo spina leviter evoluta 10-17 mm longa; pars apicalis sterilis 20-25 mm longa, 8-11 mm lata, margine dentibus 7-8 papyraceis munita vel inermis, supra glabra pagina brunneo-viridia marmorata papyracea vel siccata resinata, infra pube ferruginea. *Megasporae* 2-6 pro sporophyllo, globosae, brunneae; parum glaucae c. 32-35 mm longae, 25-27 mm diametro.

Holotypus: J.R. Maconochie 1314, 16 km N. of Katherine, N.T., 10.vi.1971 (NT); female plant, two sheets.

Isotypi: BRI, CANB, K, L, PERTH.

Palm-like *shrub* to 3 m high, trunk about 17-30 cm diameter. Fronds dark-green, flattened or arcuate in cross section, (60-)80-90(-115) cm long, (9-)15-20 (-27) cm wide. Leaflets or pinnae (150-)200-280(-300) in number with revolute margins, glabrous or pubescent above, pubescent in channels below. *Pinnae* 8-12 cm long, 2.5-3 mm occasionally 4 mm wide, straight to slightly curved, apex attenuate to mucronate with a small spine 1 mm long, slightly angled on the rhachis, not decurrent on the rhachis. *Rhachis* (including petiole) round to tetragonal towards the base, about 10 mm wide and 8 mm thick at base to 2 mm wide near tip, glabrous to scurfy-ferruginous. *Male cone* narrow-ovoid, 17-26 cm long and 5-6 cm wide, microsporophyll deltoid 15-25 mm long, 5 mm and 12 mm wide at base and apex respectively, with the terminal portion 6-10 mm long, grey-pubescent with a hooked tip in the same plane. *Megasporophyll* ferruginous to 15 cm long, with elliptic-rhombic sterile apex and a weakly developed spine 10-16 mm long. Sterile apical region 20-25 mm long, 8-11 mm broad with 7-8 fine papery marginal teeth or entire, lower surface ferruginous-pubescent, upper surface glabrous with a mottled brown-green papery or dried resinous surface. *Megaspores* 2 to 6 per sporophyll, globular-ovoid, brown in colour, surface slightly glaucous, about 32-35 mm long and 25-27 mm in diameter (Fig. 1).

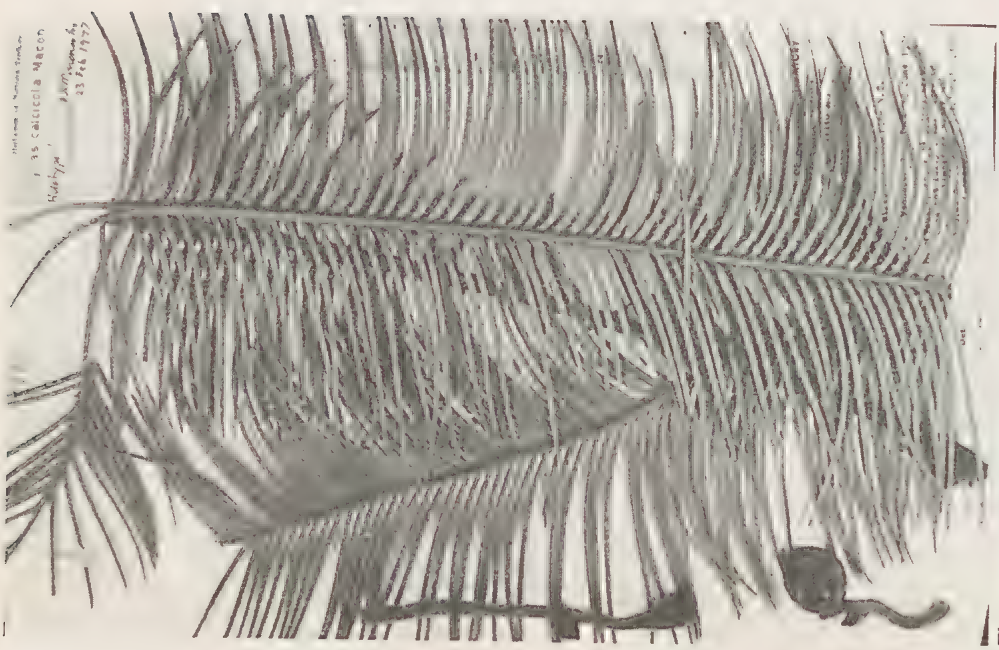

Fig. 1. *Cycas calcicola* Maconochie, holotype, (*Maconochie 1314*, NT).

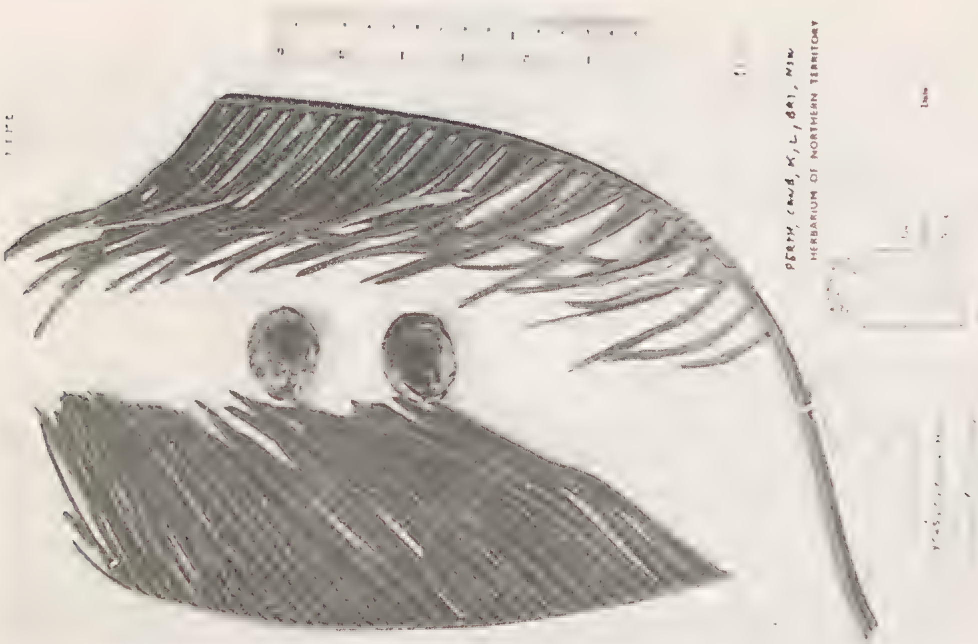

Fig. 2. *Cycas pruinosa* Maconochie, holotype, (*Symon s.n.*, NT).

Selected specimens

NORTHERN TERRITORY: *M. Lazarides 6624,* 13 km N.W. of low level crossing at Katherine, 9.vii. 1961 (CANB, K); *7650,* East Alligator River, 12°47'S, 133°21'E, 18.vii. 1972 (BRI, CANB, DNA, K, US); *J.R. Maconochie 967,* 20 km N. of Katherine, 7.ix.1970 (NT); *1315,* 16 km N. of Katherine, 10.vi.1971 (BRI, CANB, K, L, NSW); *2070,* Bamboo Creek, Mandora road, 13°00'S, 130°45'E, 16.v.1975 (L, NT, NSW, PERTH).

The specific epithet is derived from the most common habitat of this plant, namely, near or around limestone outcrops. *C. calcicola* appears to be restricted to the Northern Territory, being most common in the limestone outcrop areas north of Katherine. Two other isolated populations occur, one at Bamboo Creek on the Mandora road south of Darwin and the other on the East Alligator River.

2. **Cycas pruinosa** Maconochie, sp. nov.

Frutex habitu palmae ad 2 m altus, caudice 25-40 cm diam. Folia viridia U-vel V-formia in sectione transversali, longitudinalitor recta vel leviter curvata, 90-100 cm longa, 16-36 cm lata. *Pinnae* 120-240, lineares utrinque glabro apice attenuatae, mucrone 2 mm longo, margine revolutae, basi non decurrentes, 11-20 cm longae, 2-4 cm latae, apicem versus curvatae et interdum tortae. *Rhachis* tetragono-applanata, 11 mm lata, infra in sicco canalibus duobus utroque costae latere. *Conus masculinus* anguste deltoideus, 38-50 cm longus, 9 cm latus; microsporophyllum deltoideum 15-20 mm longum, basi 5 mm latum, in medio 15 mm latum, appendice terminali 8-15 mm longa caeruleo-cinerea pubescenti deflexa apice sursum flexa. *Megasporophyllum* ferrugineum, 27-30 cm longum, pars apicalis 14-15 cm longa dentibus 20-30 ad 25 mm longis 3-4 mm latis pinnato-dentata, apice 30-70 mm longa. *Megasporae* plerumque 4 pro sporophyllo brunneae ad dilute caeruleae, globosae, c. 40 cm longae, 30-35 mm diam. pruina cinereo-alba.

Holotypus: D. Symon s.n., Ternonis Gorge, Durack Ranges, Western Australia (17°25'S, 127°20'E), June 1975 (NT); female plant, three sheets.

Isotypi: BRI, CANB, K, L, NSW, PERTH.

Shrub to 2 m high, trunk 25-40 cm in diameter. Fronds grey-green, U- or V-shaped in cross-section, longitudinally straight to slightly curved, 90-100 cm long, 16-36 cm wide. *Pinnae* 120-240, with revolute margins, glabrous above and below, 11-20 cm long, 2-4 mm wide, apex attenuate with a pointed tip 2 mm long, pinnae acutely angled on the rhachis, curved forward, occasionally twisted towards the apex, not decurrent on the rhachis. *Rhachis* (including petiole) tetragonal-flattened, glabrous, 11 mm wide, when dry having two channels below on either side of the main vein. *Male cone* narrow-deltoid 38-50 cm long, 9 cm wide, microsporophyll deltoid 15-20 mm long, 5 mm and 15 mm wide at base and middle respectively with an equally long (8-15 mm) terminal blue-grey pubescent appendage, directed downwards but upturned at the tip. *Megasporophyll* ferruginous, 27-30 cm long with terminal part 14-15 cm, pinnate-dentate, 20-30 teeth up to 25 mm long, 3-4 mm wide, terminal tip 30-70 mm long. *Megaspores* mostly 4 per sporophyll, brown to bluish, globular-ovoid, about 40 mm long, 30-35 mm diameter, surface grey-white pruinose (Fig. 2).

Selected specimens

WESTERN AUSTRALIA: *R.A. Perry 3073,* the Grotto, Carr Boyd Range, Kununurra, 26.vii.1952 (CANB, NT); *E.C.B. Langfield 312,* Ivanhoe Station (CANB); *J.R. Maconochie 1127,* Middle Spring, Deception Ranges, 20.v.1971 (CANB, BRI, K, PERTH).

The specific epithet is derived from the pruinose surface of the magaspores.

Cycas pruinosa differs from *C. calcicola* in the absence of indumentum in the channels on the undersurface of the pinnae, in the U- to V-shaped versus flattened-arcuate cross-section of the frond, in the more flattened rhachis and in the size and shape of megasporophyll. *C. pruinosa* is restricted to the ranges west and south of the Kununurra-Ord River area of Western Australia. It is found mostly on hill slopes and at bases of steep cliffs.

Partial key to Australian *Cycas* species

1. Pinnae with revolute margins, 2-3(-4) mm wide
    2. Pinnae pubescent, or if glabrous above then pubescent in channels below, 2-3 mm wide .... *C. calcicola* (N.T.)
    2. Pinnae glabrous above and below
        3. Megasporophyll long (280-320 mm), ferruginous, with large well developed teeth (pinnatifid); pinnae 2-3 mm wide .... *C. pruinosa* (W.A.)
        3. Megasporophyll short (180-210 mm), ferruginous, teeth weakly developed or none; pinnae 3-4 mm wide .... *C. cairnsiana* (Qld)
1. Pinnae with flat margins, 2-3-4 mm wide .... *C. media* and allies

Acknowledgements

I wish to thank Dr W.T. Stearn of the British Museum (Natural History) for preparing the Latin descriptions and a number of colleagues for collecting material of the various species. This paper was prepared during my tenure as Australian Botanical Liaison Officer, Kew 1976/77 and I am grateful for the working facilities made available by the Director.

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NOTES ON THE GENUS *ACACIA* IN THE NORTHERN TERRITORY

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Abstract

Four new *Acacia* species are described from the central Australian region of the Northern Territory, viz. *A. ammobia* Macon., *A. ayersiana* Macon., *A. macdonnelliensis* Macon., and *A. olgana* Macon. The new combination *A. multisiliqua* (Benth.) Macon., is provided for the tropical taxon, *A. simsii* var. *multisiliqua* Benth. One new record is noted, namely *A. laccata* Pedley.

1. Acacia multisiliqua (Benth.) Maconochie, comb. et stat. nov.

Basionym: A. simsii A. Cunn. ex. Benth. var. *multisiliqua* Benth., Fl. Aust. 2 : 383 (1864).

Holotypus: BM — *R. Brown* "Mimosa multisiliqua No. 6 desc. Carpentaria Island, 1803".

Isotypi: E, K.

When Bentham (1864) described this taxon as a variety of *A. simsii* he commented that when he first saw Brown's specimens from the Carpentaria Islands he was inclined to regard them as representing distinct species under Brown's manuscript name of *A. multisiliqua* but subsequently found that the two forms pass one into the other.

Pedley (1975) cited the sheet "A. Cunn. 211, Cleveland Bay, 2nd Voyage of Mermaid 1818", at Kew as the holotype. Unfortunately this citation is incorrect as the specimen No. 211 is from Sim's Island, April 1818 and the Cleveland Bay specimen is June No. 314, 1819. This confusion is easily made as the K sheet has three unnumbered specimens on it and a label with the following notes:

"Sim's Island	April	$\frac{211}{1818}$
Cleveland Bay	June	$\frac{314}{1819}$
Repulse Bay	June	$\frac{316}{1819}$

East Coast, Tropical Australia
A. Cunningham"

In the original description Bentham (1842) cited "N.E. Coast, Clevelands' Bay — Cunningham" and several other specimens. Hence the type citation should read, "A. Cunn. $\frac{314}{1819}$ Cleveland Bay, 2nd Voyage of Mermaid".

Reference to Cunningham's unpublished manuscript at K and duplicate sheets at BM does not clarify the use of the epithet "simsii", but it does verify the Cleveland Bay specimen as 314. Whether Cunningham intended to name this species after Dr John Sims of England or after Sim's Island is unclear. King (1826) named Sim's Island in honour of Dr Sims at Cunningham's request. Reference to Cunningham's manuscript shows no details alongside number 211 except, "1st Voyage of Mermaid"; while under 314, "Acacia sp. foliis linearibus .... Cleveland Bay 14 June," over which has been added "*simsii* A. Cunn. Lond. J. Bot. v.1 p. 365". Examination of these historical specimens at K and BM show them as mixed collections on the same sheet in several cases. The concept and distribution of *A. simsii* A. Cunn. ex. Benth. as proposed by Pedley (1975) is not in doubt only further clarification of individual specimens was needed.

Specimens 314, 316 are *A. simsii* while 211 from Sim's Island is *A. multisiliqua*, which is restricted to the Northern Territory and Queensland in Australia and is readily distinguished from *A. simsii* as follows:

Seeds obloid 4-5 mm long, 2 mm diam.; pods with constriction between seeds; phyllodes falcate 40-60 mm long, 6-10 mm broad; heads shortly pedunculate, peduncle 3-6 mm long .... *A. multisiliqua*

Seeds subglobular 2.5-3 mm diam., 1.5 mm thick; pod flattened, 6 mm wide with distinct suture or ridge on each side; phyllodes straight to slightly curved, tapered at each end 12-15 cm long, 5-7 mm broad; heads pedunculate, peduncle 5-10 mm long .... *A. simsii*

In F. Mueller's 'Iconography of Australian species of Acacia' Dec. VII (1887) the illustration of fruiting material and seed is *A. simsii* but the central portion with flowers and broad phyllodes is *A. multisiliqua.*

Description

An erect, often spindly, small *shrub* to 2 m tall. *Phyllodes* short, falcate, (35-)40-60(-80) mm long, (4-)6-10(-12) mm wide at its broadest point, 3-5 nerved, with a weak mucro at the tip, surface dull, papillose, gland adaxial 6-9 mm from the base of the phyllode. *Inflorescences* single or paired, heads globular and 5-6 mm in diameter, peduncles 3-6 mm long. *Flowers* 5-merous, *calyx* lobes linear-spathulate with ciliate tips about 1.5 mm long, *corolla* 2-2.5 mm long, almost divided to base, petals acute, glabrous with thickened tip and central nerve. *Ovary* glabrous. Bracteoles linear, with a large spathulate terminal point. *Pods* 50-60 mm long, 3-4 mm wide, constricted between seeds. Seeds arranged longitudinally and up to 7 in the pod, obloid, 4-5 mm long, 2 mm in diameter.

Selected specimens

R. Brown, Carpentaria Island (type) (BM, K); *A. Cunningham 211,* Sim's Island, 1818 (BM, K); *D. Hinz 71-110,* Mt. Saunders, Gove, 1.x.1971 (CANB, K, NSW, NT); *D. Hinz 741611,* Gove, 16.xi.1974 (DNA, K, NT, PERTH); *R.L. Specht 381,* Hemple Bay, Groote Eylandt, 6.v.1948 (K).

2. Acacia laccata Pedley, Proc. Roy. Soc. Qld 75 : 31 (1964).

A new record for N.T., *J.R. Maconochie 1964,* 8 km S.W. Tin Mine (17s47'S. 137°45'E), 4.vi.1974 (BRI, CANB, DNA, NT).

3. Acacia pachycarpa F. Muell. ex Benth., Fl. Aust. 2 : 408 (1864).

A. crassifrugis Tindale et Maconochie, Contr. N.S.W. Nat. Herb. 4 (5) : 267 (1972), syn. nov.

Pedley (1974) stated that *A. crassifrugis* Tindale et Maconochie was likely to prove conspecific with *A. pachycarpa* F. Muell. ex Benth. The type of the latter name comprised two elements one of which was *A. ancistrocarpa* Maiden et Blakely. Since the publication of *A. crassifrugis* further field trips have been made into the type localities of both species and the results of these studies indicate that *A. crassifrugis* is undoubtedly conspecific with *A. pachycarpa.* Also until further trips in the N.T.-W.A. area of Sturt's Creek have been made this species appears to be restricted to the N.T. region, as I have been unable to locate it on the W.A. side of this creek.

4. Acacia ammobia Maconochie, sp. nov.

Arbor vel *frutex* 3-6 m altus, truncis singulis vel pluribus. Cortex nigricans persistens. *Phyllodia* in arbore erectiuscula. Phyllodia complanata, linearia, rigida, coriacea, multinervia, in utraque extremitate contracta, nervo medio siccitate leviter prominentiore, 12-22 cm longa, medio 5-7 mm lata, glabra vel leviter pruinosa. *Inflorescentia* spicata, cylindrica, 25-40 mm longa, 6-7 mm diametro, pedunculo 2-3 mm longo suffulta vel sessilis. *Corolla* pentamera, glabra, usque ad dimidium divisa, lobis apice incrassatis. *Calyx* cupulatus, apicibus loborum acutis et ciliatis. Bracteola spathulata. *Ovarium* villosum, stylus glaber. *Legumen* 9-11 cm longum, 2 mm latum, secus suturam porcatum, glabrum vel

Fig. 1. *Acacia ammobia* Maconochie, holotype, *Maconochie 1646A* (NT).

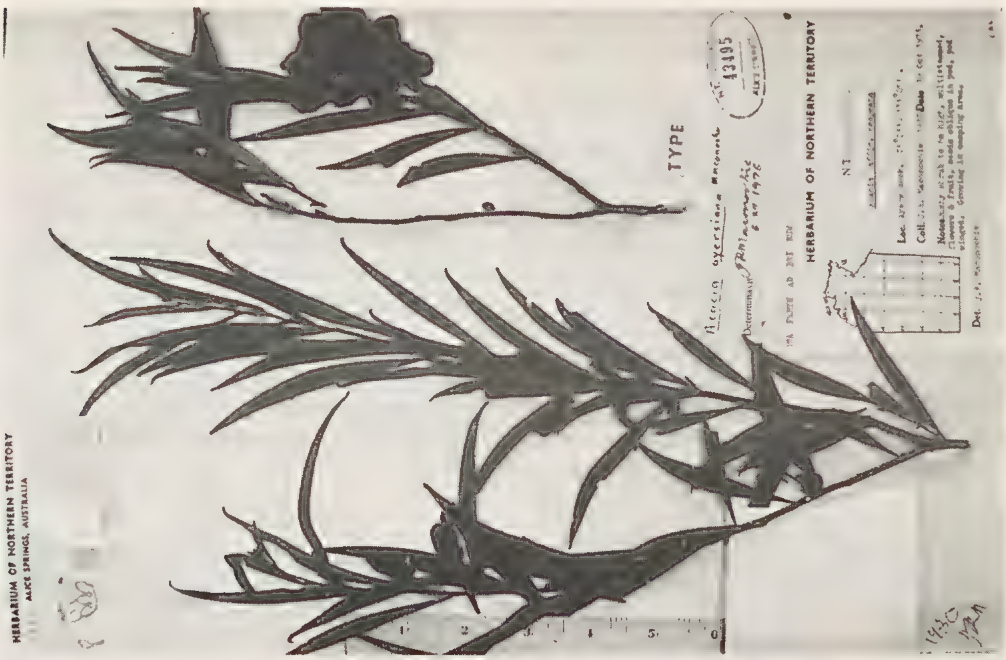

Fig. 2. *Acacia ayersiana* Maconochie, holotype, *Maconochie 1930* (NT).

aliquando pruinosum. Semen obloideum, 5 mm longum, 2 mm latum, 1 mm crassum, in legumine longitudinaliter dispositum.

Holotypus: *J. R. Maconochie 1646A*, ca. 30 km E. of Ayers Rock (25°25'S, 131°20'E) 1.ix.1972 (NT).

Isotypi: BRI, CANB, MEL, PERTH.

A small *tree* or tall *shrub* 3-6 m high with single or several stems or trunks. Bark grey-black, non-decorticating. *Phyllodes* tending to be erect on the tree. Phyllodes flattened, linear, rigid, coriaceous, multi-veined, midvein slightly prominent when dry, tapering at each end, 120-220 mm long, 5-7 mm wide at the centre, surface glabrous or slightly pruinose. *Inflorescence* a cylindrical spike, 25-40 mm long, 6-7 mm diameter, pedunculate (2-3 mm) to almost sessile. *Corolla* 5-merous, divided halfway, glabrous, apices of petals thickened. *Calyx* cupulate, sparsely sprinkled with hairs at apices of acute lobes. Bracteoles spathulate. *Ovary* villous. *Pod* 9-11 cm long, 2 mm broad, ridged along the suture, glabrous to pruinose. Seeds arranged longitudinally in pod, narrowly obloid, 5 mm long, 2 mm wide, 1 mm thick, funicle yellow-white folded and attached to one end. (Fig. 1).

Selected specimens

G. Chippendale (NT 2914), 49.8 km E. Ayers Rock, 14.ix.1956 (NT, NSW); *N.N. Donner 4347*, ca. 13 km W.N.W. Mt. Connor (25°27'S; 131°47'E), 21.viii.1973 (AD, DNA, NT); *P.K. Latz 5728*, 35 km W.S.W. Mt. Olga (25°21'S; 130°27'E), 22.ix.1974 (DNA, NT, PERTH); *J.R. Maconochie 1800*, 37.5 km E. Ayers Rock (25°20'S; 131°28'E), 17.x.1973 (NT).

This species is allied to *A. doratoxylon* of eastern Australia and *A. lasiocalyx* of Western Australia. It differs from the former in having longer and less falcate phyllodes, longer inflorescences, an erect habit and phyllodes without the 3 prominent veins as noted by Maiden (1909) for *A. doratoxylon*. *A. lasiocalyx* has villous calyces and much longer and more flexible phyllodes with prominent central nerve.

5. **Acacia ayersiana** Maconochie, sp. nov.

Arbor parva vel *frutex* pluricaulis, 3-6 m altus, cortice nigricanti semi-persistenti. *Phyllodia* complanata, lanceolata vel falcata, plurinervia utraque extremitate contracta, paginis glabris obscuris vel subtiliter sericeis, apice recto vel leniter uncato, 50-100 mm longa et medio 5-10 mm lata, margine glutinoso-cerino. Glandula basalis circularis, inconspicua vel obsoleta. *Inflorescentia* spicata, cylindrica, 15-25 mm longa, 3-6 mm diametro, pedunculo 2-3 mm longo vel nullo, rhachis glabra, bracteolis spathulatis. *Flores* pentamera, *calycis* lobi spathulati, glabri vel glutinosi; *corolla* glabra vel leviter glutinosa vel sericea, calyce duplo vel triplo longior, lobis costa valida et apicibus incrassatis instructis. *Ovarium* bruneum, leviter sericeum vel glabrum. *Legumen* complanatum, pedunculatum (4-6 mm) margine 1 mm alatum, reticulatum, sericeum vel glabrum, seminibus transversim dispositis. Semina anguste ovoidea, 5-6 mm longa, 2-3 mm lata, funiculo albo ad apicem seminis plicato.

Holotypus: *J.R. Maconochie 1930*, Ayers Rock (25°23'S, 131°05'E), 19.x.1973 (NT).

Isotypi: AD, BRI, DNA, NSW, PERTH.

Small *tree* or several stemmed *shrub* from 3 to 6 m high with black-grey semi-persistent bark. *Phyllodes* flattened, lanceolate to falcate, multi-veined, tapering at each end, with dull glabrous or finely sericeous surface, tip straight or weakly hooked, 50-100 mm long and 5-10 mm wide at the middle, margin yellow-brown and glutinous. Gland circular, basal but inconspicuous or absent. *Inflorescence* a shortly pedunculate (2-3 mm) cylindrical spike, 15-25 mm long, 3-6 mm in diameter, rhachis glabrous, bracteoles spathulate. *Flowers* 5-partite. *Corolla* glabrous or sericeous (sometimes slightly glutinous), petals with strong midribs and thickened apices. *Calyx* lobes spathulate, 1/2/-1/3 length of corolla, glabrous or glutinous-sericeous. *Ovary brownish, weakly* sericeous to glabrous. *Pods* flattened, pedunculate (4-6

mm), margin with 1 mm wide wing, with reticulate, sericeous or glabrous surface, seeds arranged transversely in pod. Seeds narrowly obloid, 5-6 mm long, 2-3 mm broad. Funicle white, folded at end of seed. (Fig. 2).

Selected specimens

J.R. Maconochie 643, Ayers Rock, 17.i.1969 (NT); *J.R. Maconochie 1928*, 75 km N-E Docker River Settlement, 29.viii.1973 (NT).

This species is allied to *A. kempeana* and *A. aneura* var. *latifolia;* it differs from the former in the longer phyllodes with a tapering acute apex and shorter but broader winged pods. From *A. aneura* var. *latifolia* it differs in the broader pod and larger phyllodes.

6. **Acacia macdonnelliensis** Maconochie, sp. nov.

Arbor vel *frutex* 3-6 m altus, truncibus singulis vel pluribus. *Phyllodia* in arbore erectiuscula. Phyllodia complanata, linearia, falcata, multinervia glabra vel leviter glutinosa, apice leviter uncinata, (50-)70-100(-120) mm longa, 1.5-5 mm lata. Glandula basali inconspicua vel obsoleta. *Inflorescentia* spicata, cylindrica, 20-30 mm longa, 5-6 mm diametro, pedunculo 4-5 mm longo, rhachis glabra, bracteolis spathulatis. *Flores* pentamera; *calyx* cupulatus, lobis acutis parvis circiter tertia parte longitudinis calycis, basi sparse villosus. Lobi *corollae* acuti, glabri, apice incrassato, calyce circiter bis longiores. *Ovarium* glabrum vel sericeum. *Legumen* sessile, angustum, lineare, inter semina leviter constrictum, pagina fusca reticulata et leviter glutinosa, 40-50 mm longum, 3-4 mm latum. Semina nigro-fusca, anguste obloidea, longitudinaliter disposita, 4-5 mm longa, 1.5 mm lata, funiculo luteolo, ad apicem seminis plicato.

Holotypus: *J.R. Maconochie 440,* Serpentine Gorge, 29.vii.1967 (NT).

Small *tree* or tall *shrub* to 3-5 mm high with one or several trunks. *Phyllodes* flat, erect, linear, falcate, multinerved, glabrous or slightly glutinous, tip weakly hooked, (50-)70-100(-120) mm long, 1.5-5 mm wide. Gland basal, inconspicuous or absent. *Inflorescence* a cylindrical spike, 20-30 mm long, 5-6 mm in diameter, peduncles 4-5 mm long, rhachis glabrous, bracteoles spathulate. *Flowers* 5-partite; *calyx* cupular with sparse villous pubescence at base, lobes acute and small (to about 1/3 length of calyx). *Corolla* lobes acute, glabrous with thickened apices about twice the length of calyx. *Ovary* glabrous or with fine silky pubescence. *Pods* sessile, narrow, straight, slightly constricted between the seeds, dark brown, reticulate and slightly glutinous, 40-50 mm long, 3-4 mm wide. Seeds arranged longitudinally in pod, black-brown, narrowly obloid, 4-5 mm long, 1.5 mm broad, funicle yellow-white, folded at end of seed. (Fig. 3).

Selected specimens

G. Chippendale (NT 3595), Bagots Creek, George Gill Range, 13.viii.1957 (NT); *P.K. Latz 5804*, Macdonald Downs, 24.x.1974 (NT, PERTH); *J.R. Maconochie 452*, Standley Chasm area, 8.viii.1967 (NT).

This species is allied to *A. adsurgens* Maiden et Blakely but differs in its broader phyllodes and in having a tree rather than a multi-stemmed rounded shrub habit. *A. adsurgens* is a species of the spinifex sand plains while *A. macdonnelliensis* mostly grows on ridges, hillsides and gullies of the ranges in central Australia.

7. **Acacia olgana** Maconochie, sp. nov.

Arbor vel *frutex*, 3-15 m altus, truncis singulis vel pluribus. *Phyllodia* multinervia, nervo medio siccitate aliquando leviter promeninentiore, lata, recta, aut leviter curvata vel falcata, glabra aut leviter pruinosa (60-)90-120(-150) mm longa, (2.5-)3-4(-5) mm lata. *Inflorescentia* spicata, sessilis, cylindrica, 17-22 mm longa, 3-4 mm diametro. Rhachis pubescens, sub fructu glabrescens. *Flores* pentamera; *sepala* spathulata, ciliata, ca. 1 mm longa; *corolla* glabra, ca. 1.5 mm longa. *Ovarium* papillosum, stylus glaber. *Legumen* sessile, laeve, nitidum, chartaceum, glabrum vel sparse pilosum, basi aliquando pubescens, 40-70 mm longum, 3-4 mm latum. Semen subglobosum, fusco-nigrum, nitidum, 3 mm longum, 2.5 mm latum, 2 mm crassum, in legumine longitudinaliter dispositum.

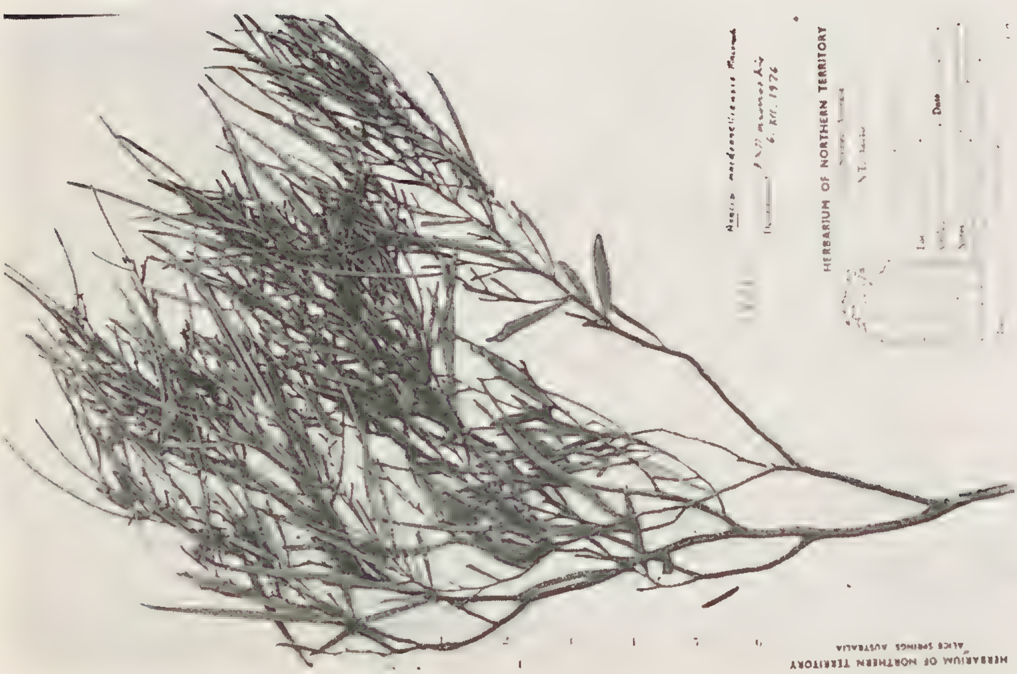

Fig. 3. *Acacia macdonnelliensis* Maconochie, holotype, *Maconochie 440* (NT).

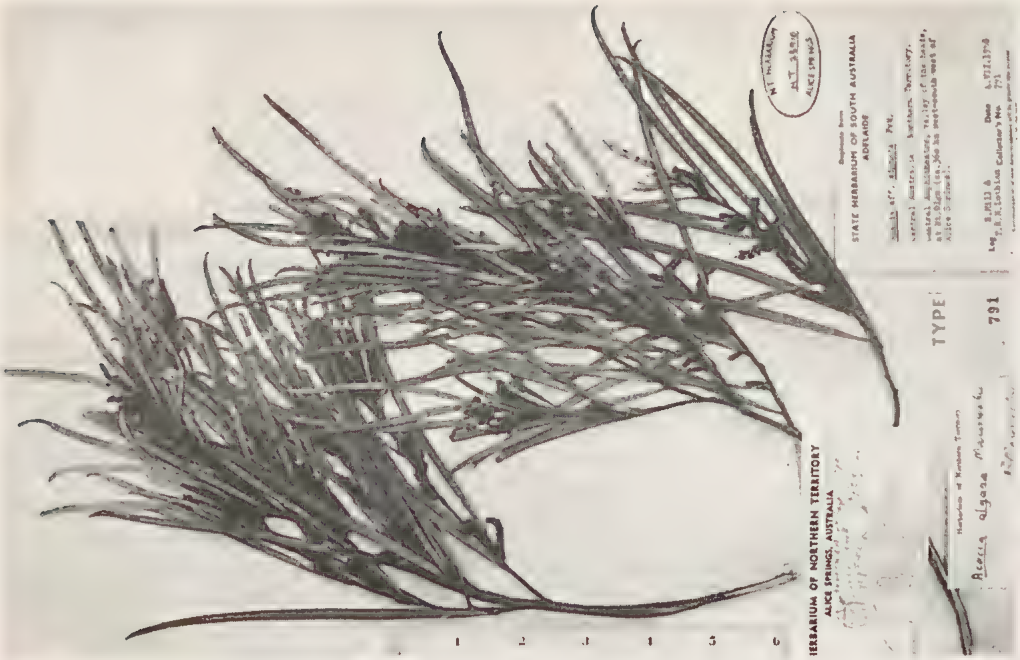

Fig. 4. *Acacia olgana* Maconochie, holotype, *Hill & Lothian 791* (NT).

Holotypus: *R. Hill & T.R.N. Lothian 791,* Central Amphitheatre, Valley of Heads, at Mt. Olga, N.T., 4.vii.1958 (NT).

Isotypi: AD, K.

A *tree* from 3 to 15 m high, single-stemmed or with several main stems or trunks. Bark rough, grey-brown, flaky but persistent. Branchlets reddish with a whitish reticulate-ovate pattern of flaking bark. *Phyllodes* many nerved, sometimes the central one slightly more prominent when dry, flat, tapering towards the hooked tip, straight to slightly curved or falcate, shiny, glabrous or with a weakly developed pruinose surface (60-)90-120(-150) mm long, (2.5-)3-4(-5) mm broad. Gland yellow-brown ovoid, about 0.5 mm long, about 3 mm from base. *Inflorescences* single or paired cylindrical sessile spikes, 17-22 mm long and 3-4 mm in diameter. Rhachis of inflorescence with yellow silky pubescence but becoming sparse or glabrous when with fruit. *Flowers* 5-merous, *sepals* spathulate, ciliate, about 1 mm long, *corolla* glabrous, divided in upper third, 1.5 mm long, 1 mm at widest, with a central ridge, lobes 0.5 mm long. *Ovary* papillate hairy. *Pod* sessile, smooth, shiny, papery, glabrous or with very sparse hairs, sometimes pubescent at the base, convex on opposite sides over successive seeds, suture edges straight, 3-4 mm wide and 40-70 mm long. Seeds subglobular, brown-black, shiny, 3 mm long, 2.5 mm wide, 2 mm thick, arranged longitudinally in pod. Funicle yellow-white, small, folded but not encircling the seed. (Fig. 4).

Selected specimens

P.K. Latz 1793, Petermann Ranges (25°07'S, 129°24'E), 24.ix.1971 (DNA, NT); *J.R. Maconochie 1649,* Olga Gorge (25°25'S, 130°50'E), 1.ix.1972 (NT, PERTH); *J.R. Maconochie 1931,* loc. cit., 19.x.1973 (BRI, DNA, NT, NSW, PERTH).

This species is allied to *A. signata* but differs in having (a) narrower phyllodes without red margin, (b) spathulate sepals, (c) glabrous corolla, (d) narrower more papery fruit and (e) not the centrally prominent vein as referred to by Maiden (1917) where the description of *A. signata* was emended.

Acknowledgements

I wish to thank Mr A.K. Airy Shaw for correcting the Latin descriptions. This paper was prepared during my tenure as Australian Botanical Liaison Officer, Kew 1976/77 and I am grateful for the working facilities made available by the Director.

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VARIATION IN *LENBRASSIA* G.W. GILLETT (GESNERIACEAE)

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Abstract

Variation is documented in *Lenbrassia australiana* (C.T. White) G.W. Gillett, and a new variety described, var. *glabrescens*. Additional specimens of var. *australiana* are listed and described, together with line drawings of both taxa.

Introduction

In 1974 Gillett described the genus *Lenbrassia* (Gesneriaceae), with *Coronanthera australiana* C.T. White (1936), being basionym for the new combination *Lenbrassia australiana* (C.T. White) G.W. Gillett. The new genus commemorated Leonard Brass who collected the holotype, *Brass 2087* on Mt Demi, Queensland (BRI 011304), and also collected extensively in the south-western Pacific area.

Gillett described *Lenbrassia* because these Queensland plants have fleshy fruits unlike *Coronanthera*, (tribe *Coronanthereae*), which is characterised by capsular fruits and wind dispersed seed. *Lenbrassia* also has a larger cylindrical corolla making "it a strongly discordant element in the *Coronanthereae*", as Gillett noted. He related *Lenbrassia* to *Fieldia* A. Cunn., see Hooker (1858), in the tribe *Mitrarieae*, so giving Australia two genera in this tribe, with another three, *Asteranthera* Kl. & Hanst., *Mitraria* Cav., and *Sarmienta* Ruiz & Pav., (Munoz Pizarro, 1966 : t. 47, 44 & 43 respectively), found in South America. The recognition of *Lenbrassia* consequently strengthens a phytogeographical concept of the tribe *Mitrarieae* having a disjunct distribution between Australia and South America, a distribution found in other groups such as the genera *Lomatia* R. Br. (Proteaceae), *Eucryphia* Cav. (Eucryphiaceae) and *Nothofagus* Blume (Fagaceae). Recognition of *Lenbrassia* also requires that *Coronanthera* be regarded as not indigenous to Australia, see Gillett (1967).

Variation

Gillett carried out fieldwork in northern Queensland in August 1973 making it possible for him to examine both flowers and fruit and to collect specimens, *Gillett 2606* (A, BRI, E, K, L, UC) from between Mt Lewis and Mt Demi on which his figure (Gillett, 1974 : figure 1) is based. It is therefore surprising that the copious filament hairs shown in our accompanying illustration are not represented in Gillett's drawing, and that the band of hairs at the mouth of the corolla tube in our live specimens are apparently confined to the inside of the lobes in Gillett's illustration. The *Gillett 2606* collection has been examined closely and the filaments bear hairs as shown in our illustration, (Fig. 1). Gillett also described the filaments as "twisted and curved", but in bud, at which time the protandrous anthers have released their pollen, the filaments are not contorted but only upcurved as shown in our illustration. The stigma projects above the adherent anthers at bud stage. Only when the corolla expands do the filaments become twisted and anthers often part company. The pollen is pale cream in colour. While observations are lacking, the flowers appear to be animal pollinated and outcrossing.

Gillett does not mention the somewhat narrower, virtually glabrous adaxial leaf surfaces of specimens *White 10548, Brass and White 220* and *Merrotsy 27*, all of which he saw, nor their pedicels 2-4 cm long on peduncles about 1 cm long, exceeding the dimensions of the smaller, more typical organs seen and quoted by Gillett. Since Gillett's (1974) paper, the Queensland Herbarium has acquired another specimen, *Hyland 7084*, and the Atherton Herbarium of the C.S.I.R.O. Division of Forest Research (QRS) holdings have been inspected, all specimens having almost glabrous upper leaf surfaces. When these collections are compared with other available *Lenbrassia* material, they stand apart on the above characters, and also because the vestiture on the pedicels, abaxial leaf veins and midrib tends

Fig. 1. *L. australiana* var. *australiana, Harman s.n.*, a. shoot in fruit; b. dissected bud; c. dissected corolla; d. calyx and corolla in profile; e. detail of abaxial leaf base to show vestiture. Illustration by L. Dutkiewicz.

to be adpressed, not erect and at right angles to the tissue surfaces as in more typical specimens. On the basis of specimens available, it also seems that the inflorescence develops only one flower, unlike more typical material which develops three per peduncle in a cymose arrangement, and this may also explain why these atypical collections with solitary flowers appear to have longer and broader mature fruits.

Nothing is known of the breeding system of either typical or atypical plants of *Lenbrassia,* but the morphological differences do not seem to intergrade to any appreciable extent in the apparently similar rainforest habitat shared by the two sorts of plant. Whatever the factors responsible for these differences it seems worthwhile to give taxonomic recognition to the variation, but this raises a problem of taxonomic judgement.

All genera in the tribe *Mitrarieae* are monotypic, on the basis of present taxonomic understanding, including the Australian representatives *Fieldia* and hitherto *Lenbrassia.* The patterns of variation produced by evolutionary change within such monotypic genera are unknown, although there are large-flowered forms of the Chilean *Mitraria coccinea* Cav. in cultivation in European gardens sometimes known as 'Dr. Clark's form', yet *Sarmienta, Fieldia* and *Asteranthera* seem to lack significant variation. Responsible delimitation of new (polytypic) taxa is consequently made difficult, there being no precedent in the tribe.

Taxonomy

Trinomial nomenclature has its physical disadvantages, but seems to accomodate the present situation best, where there is a need to document variation in the absence of a thorough systematic knowledge of the tribe. Consequently, I propose the following new variety:

Lenbrassia australiana (C.T. White) G.W. Gillett var. **glabrescens** var. nov.

— varietas a typo divergens foliis angustioribus, super glabriusculis, pedicellis longioribus, pilis adpressis.

— variety diverging from the type by the narrower leaves, above almost glabrous, by the longer pedicels with hairs adpressed.

Type: Hyland 8297, V.C.L. Noah, 16'10°S, 145'25°E, 600 m in rainforest (QRS 007754, holotype; QRS 007753, isotype).

Habit a multi-stemmed shrub or tree to 6.5 m high, young growth adpressed villose, older growth becoming glabrescent; *leaves* opposite, dark green above, paler below, midrib sometimes reddish, glabrous or rarely glabrescent above, glabrescent below (veins with 3-5-celled adpressed transparent hairs, lamina glabrous or sparsely pilose); *petiole* 6-13 mm long, finely adpressed pilose, blade oblanceolate to lanceolate, apex acute-acuminate, base cuneate, 7.6-15.4 cm long, 2.2-5.1 cm wide, primary veins 6 to 8 on either side, curving towards margin, subsidiary venation more obscure, margin more conspicuously serrate nearer apex; *inflorescence* adpressed pilose, single-flowered, peduncle axillary 3-10 mm long, terminated by a pair of caducous, linear bracts 1-3 mm long, bracts subtending a pedicel 1.3-4.2 cm long; *calyx* persistent, tube clasping base of mature fruit, calyx c. 12 mm long at anthesis, 5 free lobes, c. 8.5 mm long, linear-acuminate, adpressed pilose, hairs 3-4 celled, c. 0.5 mm long; *corolla* orange-yellow, cylindrical, externally puberulent, 1.9-2.5 cm long, dissected c. 6 mm into 5 unequal rounded lobes, posterior pair shorter, c. 3 mm long; *stamens* 4, borne as 2 lateral pairs, anthers coherent, filaments yellow, c. 10 mm long, pale pilose at and near point of insertion on corolla tube, adnate c. 5 mm above base of corolla tube; *ovary* and *style* c. 18 mm long at late anthesis, sparsely pubescent with small, erect, eglandular hairs, ovary tapering uniformly and concavely into style, placentation parietal, disk annular and cupular, small; *stigma* glabrous, dilated, stomatomorphic, entire; *fruit* c. 2 cm long, obclavate, glabrescent to glabrous, tipped by c. 1.2 cm long persistent style base; *seeds* ovoid, brown, c. 0.6 mm long, testa longitudinally striate, (Fig. 2).

Fig. 2. *L. australiana* var. *glabrescens*, *White 10548;* a. flowering shoot; b. detail of abaxial leaf base to show vestiture. Illustration by L. Dutkiewicz.

Distribution

QUEENSLAND: Thornton Peak, *Brass & White 220* (BRI 220046, K): Zarda – Root's Creek Track, *Flecker 1202* (QRS 007750): T.R. 150, Zarda Logging Area, *Hyland 4932* (QRS 007752): N.P.R. 164, Thornton Peak, *Hyland 7084* (BRI 208037): Mount Spurgeon, *Merrotsy 27* (BRI 220047, K): Mount Spurgeon, *White 10548* (BRI 220044 & 220045, K).

Recognition of *L. australiana* var. *glabrescens* makes it desirable to redefine *L. australiana* var. *australiana* as follows:

Lenbrassia australiana (C.T. White) G.W. Gillett var. **australiana**

Type: Brass 2087, Mount Demi, N. Queensland, 760 m in rainforest (BRI 011304, holotype).

Habit a branching tree to 13 m high, young growth densely pilose-pubescent (i.e. hairs erect), coloured purple, older growth becoming pilose to glabrous with age; *leaves* pilose to scabrous above and below (veins with 5-7 celled, erect, transparent hairs, lamina pilose to scabrous); *petiole* 5-27 mm long, densely pilose with erect, transparent hairs, base cuneate, 5.0-20.5 cm long, 2.5-6.5 cm wide, primary veins 7 to 9 on either side, margin sharply serrate, teeth to 2 mm long; *inflorescence* scabrous-pilose, cymose, usually with 3 flowers, peduncle axillary 5-20 mm long, linear bracts 3-10 mm long, bracts subtending pedicels each 5-15 mm long; *calyx* 10-12 mm long at anthesis, free lobes c. 8 mm long, erect scabrous-pilose, hairs 3-6 celled; *corolla* orange, externally pubescent, hairs erect, corolla 1.6-2.0 cm long, dissected 2-4 mm into 5 unequal rounded lobes; *stamens* 4, filaments 9-10 mm long; *ovary* and *style* 15-16 mm long at late anthesis, pubescent-pilose with erect hairs; *fruit* 1.5-2.0 cm long, pubescent-pilose, tipped by 7-12 mm long persistent style base, (Fig. 1).

Distribution

QUEENSLAND: 13 km N.W. Julatten P.O., *Coveny & Hind 7231* (BRI 208161, QRS 007751): Mount Lewis, *Irvine 611* (BRI 208804, QRS 007743, 007744, 007745): S.F.R. 143, North Mary Logging Area, *Hyland 5705* (BRI 160724) and *6736* (BRI 209539): S.F.R. 143, South Mary Logging Area, *Hyland 6730* (BRI 209540): Mount Lewis, *Risley 144* (BRI 206607, QRS 007747, 007748, 007749): Mount Lewis, North Mary Logging Area, *Risley 84* (BRI 207366, QRS 007746): Mount Lewis, *Harman s.n.* (AD Herb. Pl. Cult. 6993): Mount Lewis *Lothian s.n.* (AD Herb. Pl. Cult. 6991): Mount Lewis, *Smith & Pedley 10099* (BRI 188039): Mount Lewis, *Schodde 4151* (AD 96706101, BRI, L, A, K, CHR): Mount Misery, *Balgooy 1594* (BRI, K, UC, none seen): between Mount Lewis and Mount Demi, *Gillett 2606* (BRI 187127, A, E, K, L, UC).

Material of *L. australiana* var. *australiana* presently growing at the Adelaide Botanic Garden was introduced to cultivation by Mr C.W. Harman on June 30, 1976; he collected it on June 26, from Mount Lewis in northern Queensland at an altitude of about 900 m in dense rainforest. The area receives about 2500 mm of rain per annum. His notes read, "Compact much branched shrub or small tree on edge of clearing, but forming close growing community within the rainforest — still much branched but not as compact as when growing in more light. Favouring sloping banks of small rainforest creeks, prominently favouring the eastern banks of these streams. Not widespread but plentiful in its area. Soil deep, decomposed granite and clay and very little top soil." Harman continues "Seed was setting freely . . ." and "the plant definitely has a colonising habit. Within the area where I collected the specimens, regeneration was good and quite obvious, as I found plenty of seedlings from a few inches high and upwards . . . Some plants had their roots severed (by a road)" and "Vigorous growth had started from the severed root ends." Another living plant collected by Noel Lothian on Mount Lewis is also growing at Adelaide.

Lenbrassia australiana has considerable interest to the student of Gesneriaceae being the only tree in the tribe *Mitrarieae.* Although it is floriforous and var. *australiana* has attractive purplish vegetative parts when young, it remains to be seen how well it takes to pruning and pot culture. Other than herbarium sheet data, little is known about *L. australiana* var. *glabrescens:* it is not in cultivation.

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J. Adelaide Bot. Gard. 1(3): 193-195 (1978)

A NEW CULTIVAR — *CUPRESSUS LUSITANICA* MILL. CV. ADELAIDE GOLD

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Abstract

In 1960 a seedling of *Cupressus lusitanica* Mill. (Mexican Cypress) was noted with a distinct golden foliage colour. Following planting trials during which the constancy and distinctiveness of the form was assessed, it has been named *C. lusitanica* cv. Adelaide Gold.

Introduction

Cupressus lusitanica Mill. (Mexican Cypress or Cedar of Goa), was introduced into cultivation sometime during the 16th Century, and has been grown in England since 1683 when Bishop Compton introduced it from Portugal. Despite its colloquial names it is not a native of either Portugal or Goa in western India. It was probably introduced into Portugal from Mexico, its native country, by seamen or missionaries returning from that country. It is a graceful tree, with brown peeling bark, somewhat conical in shape, with spreading and slightly pendulous branchlets, to 30m in height, and having glaucous or greyish-green foliage and glaucous cones with pointed bosses.

No date for the introduction of *C. lusitanica* into Australia is known. George Francis (first Director of the Adelaide Botanic Garden) does not list it in his 1859 'Catalogue of the Plants under cultivation in the Government Botanic Garden, Adelaide', but Dr Richard Schomburgk (second Director of the Adelaide Botanic Garden) records both var. *benthamii* and cv. Knightiana in his 1878 'Catalogue'. W.R. Guilfoyle in 1883 records it for Melbourne Botanic Garden as "*glauca* syn. *C. lusitanica*", while Walter Hill lists it in 1875 in his 'Catalogue of Plants in Queensland Botanic Garden'.

An examination of the literature reveals that while *Cupressus lusitanica* has produced several glaucous and distinctly blue forms which have been described and known for many years, no golden colour break has been previously recorded.

History

During the period when Mr Colin Small was Superintendent of Parks to the City of Enfield, Adelaide, he raised many hundreds of plants and introduced new species to parks and street plantings. In 1960 he obtained from the late Mr Fred Couzens, Senior Gardener, Waite Agricultural Research Institute, seed of *Cupressus lusitanica*, which was sown. Amongst the resultant 50 or so seedlings was one with distinctive yellow foliage. The plant was isolated and observed to see if it retained its golden colour. The colouring was not only stable but the plant grew vigorously and in 1963-64, was planted out in the recently developed and landscaped western parkland area of Adelaide subsequently named Bonython Park.

This park has a limestone marl subsoil beneath approximately 30 cm of red clay. It was used as a rubbish dump for many years but neither this nor the effects of a windy site and possible fumes from a local gas plant effected growth of the *Cupressus*. Because of its attractive colouring, vigorous growth, tolerance to alkaline soil and bright sun-light, it was propagated from cuttings which readily struck. Plants were subsequently placed in Angas Gardens on the north side of the River Torrens where the soil is a good loam. Other plantings were made in the Women's Memorial Gardens with 30 cm of soil overlying white clay and limestone, and on the southern bank of the River Torrens immediately west of the Port Road Bridge. This last site was reclaimed with filling of various types including boiler ash and general rubbish and has a fully exposed northerly aspect.

Fig. 1. *Cupressus lusitanica* cv. Adelaide Gold original plant (1977), 6.5 m high, 3 m spread; north side of boat pool, Bonython Park, Adelaide, South Australia. Photograph by T.R.N. Lothian.

The original tree is now about 6.5 m high, 3 m broad with a somewhat truncated conical shape and the trunk clothed to the base with branches which are slightly ascending, (see Fig. 1). In the tree in the Women's Memorial Garden, branches are more horizontal. The colour has remained a clear yellow to gold, although on the shaded side of the tree the colour is more suffused with green. The plant in the Women's Memorial Gardens, in a shaded and sheltered position, also lacks bright yellow colouring of the foliage. This plant has grown about 9 m in nine years, is broadly conical in shape, and is 3 m in diameter with an unbranched trunk 20 cm in diameter at chest height.

Observations made over the years have confirmed the usefulness of this colour form as a desirable park tree having rapid growth, tolerance to alkaline soils, and resistance to bright sunlight. Its resistance to foliage burn should make it a suitable tub specimen for placing on patios, terraces or in formal plantings.

Taxonomy

An examination of the habit and vegetative characters of the colour form shows a strong similarity with that of *C. lusitanica* and although the original seed tree has now been removed the new form differs only in the foliage colour from *C. lusitanica.* None of the coloured trees has produced cones despite their age, in contrast to golden and yellow forms of *Cupressus macrocarpa* Hartweg which usually produce the typically large cones 4-6 years after planting.

Another species with a yellow form is *C. glabra* Sudw. "Smooth Arizonan Cypress". This is a small to medium tree, with dense ascending branches, red bark and greyish green resin speckled foliage. *Cupressus glabra* cv. Aurea is described as a broadly conical tree with suffused yellow foliage: according to Hillier (1974) it "originated in Australia". However, Harrison (1974) states "a most attractive neatly erect growing golden foliaged cultivar recently introduced from the U.S.A.. . . .", but Lord (1967) does not mention this form. On foliage and growth form it should be easily separated from the new cultivar described here.

Although there have been several glaucous forms named no yellow foliaged form of *C. lusitanica* has been described. Bean (1970) mentions the naturally occuring glaucous forms and "others with yellowish leaves . . . found in the wild". No yellow forms have been previously recorded or named in Australia.

The yellow form of *C. lusitanica* is now being produced in commercial quantities and a name is therefore necessary. In consultation with Mr V. Ellis, Director of the Parks, Gardens and Recreation Department, City of Adelaide and Mr Colin Small, the name 'Adelaide Gold' is proposed for this cultivar as follows:

Cupressus lusitanica Mill. cv. Adelaide Gold

Growth habit and foliage morphology similar to *C. lusitanica* but foliage and branchlets near growing points golden yellow to clear bright yellow in colour, tips of shoots — yellow/green 154A-D; general colour yellow group 8A-D, (R.H.S. Colour Chart (1966).) Cones unknown.

Holotype. North of boat pool Bonython Park, Adelaide, *T.R.N. Lothian s.n.* 8/8/77 (AD Herb. Pl. Cult. 7101).

Acknowledgements

Thanks and appreciation are recorded for the constructive criticisms received from Dr J.P. Jessop, Dr B. Morley and Mr A. Mitchell, Forestry Commission, Alice Holt, England.

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J. Adelaide Bot. Gard. 1(3): 197-199 (1978)

a224831

PLANT PORTRAIT

8. Lepechinia hastata (A. Gray) Epling (Lamiaceae).

Lepechinia hastata (A. Gray) Epling, *Bull. Torr. Bot. Cl.* 67:511 (1940).

Ic. Porsch, *Biol. Generalis.* 6 : t. 31, fig. 7 (1930), flower only.

Basionym : *Sphacele hastata* A. Gray, *Proc. Am. Ac.* 5 : 341 (1862).

Flowered Adelaide Botanic Garden on June 24, 1977, accession number 181-74, herbarium voucher AD Herb. Pl. Cult. 6995. Collected by B. Morley, but introduced as seed to Adelaide by T.R.N. Lothian from the Strybing Arboretum in 1974. Originally collected by Gankin and Herbst on Mount Haleakala at 6000 feet, Maui, Hawaii, June 24, 1968.

Perennial *herb,* c. 2.3 m tall, stems c. 1-1.5 cm thick, four-angled, purplish, closely pubescent, roots fibrous; *leaves* opposite, the largest c. 32 cm long, 15.5 cm wide at widest part, hastate at base becoming ovate on inflorescence, margin serrate-crenate, lobes of hastate leaves c. 9 cm long, leaf base cordate to auriculate, apex acute, adaxially shortly and copiously tomentose, hairs transparent, branched (simple, bi- or tri-furcate), veins impressed, c. 27, purplish, lamina finely rugose, velvety green, abaxially copiously tomentose, hairs transparent, branched as above, punctate with globules of opaque acrid-aromatic exudate in each depression, veins raised, greyish green; *petiole* c. 6.5 cm long, 4 mm thick, semi-circular in cross-section, flattened and purplish above (inflorescence leaves sessile), connected across node by pubescent ridge, vestiture as on lamina; *flowers* in axillary, cymose clusters of c. 15; *peduncles* elongating with age, c. 1.3 cm long at anthesis, purplish; *pedicels* elongating with age, c. 1.2 cm long at anthesis, purplish, pubescent; *bracts* linear c. 1.1 cm long, purplish, pubescent, *sepals* 5, fused at base, somewhat bilabiate, c. 1.1 cm long, upper 3 lobes c. 8 mm long, lower 2 lobes c. 6 mm long, triangular, purple, pubescent, 12-nerved at base, mouth closed after anthesis; *corolla* 4-lobed, gamopetalous, purple-magenta, slightly zygomorphic, c. 2.3 cm long; tube 1.8 long, c. 3 mm diameter at base, widening gradually to 7 mm at mouth, externally pubescent, hairs multicellular, simple or bifurcate, purple, internally pubescent at base, hairs unicellular, simple, clavate, glistening; posterior lobe emarginate, erect, c. 2 mm long; laterals c. 3 mm long, erect; anterior lobe c. 6 mm long, ovate, reflexed; *stamens* 4, exserted 7 mm at anthesis, posterior pair of filaments c. 1.6 cm long, anterior pair c. 1.4 cm long, glabrous, purple, inserted on middle of tube; *anthers* 2-celled, blackish-purple, divergent at anthesis, each cell c. 1.7 mm long, linear, pollen pale yellow; *style* 3 cm long, simple, glabrous, purple; *stigma* bifid, lobes acute, exserted 1 cm at anthesis; *ovary* segments 4, green, surrounding base of style, glabrous, disk yellowish, glandular; *fruit* 4 nutlets, glossy black, 5 mm long, 2.5 mm wide, apically blunt, basally constricted into a short neck.

My colleague, Mr P. Trezise, drew attention to this tall growing herb with attractive foliage and large inflorescences of small purple-magenta flowers. It was raised from seed collected from the Strybing Arboretum, San Francisco, by Mr T.R.N. Lothian in 1974. Plants were put out into the Adelaide garden on November 6, 1975, as a *Salvia* species.

I am grateful to Dr R.M. Harley of Kew who kindly confirmed identification of the plant as *L. hastata.* The most recent treatment of *Lepechinia* Willd., is that of Epling (1948), who states that *L. hastata* is the type species of section *Thyrsiflorae* Epling, and one of the two species in the section, (which is characterised by an open paniculate inflorescence having cymose branches). It is the inflorescence structure which distinguishes *L. hastata* from the most closely allied species, the Chilean *L. salviae* (Lindl.) Epling in sect. *Speciosae* Epling (illustrated as *Stachys salviae* Lindl. by M. Hart in *Edward's Botanical Register* . . . (1829) t. 1226, and W. J. Hooker as *Sphacele lindleyi* Benth. in *Curtis's Bot. Mag.* (1830) t. 2993.), introduced into England about 1826.

a. flowering shoot, b. dissected corolla, c. dissected calyx showing gynoecium, d. calyx from above.

Epling (1948) continues that *L. hastata* occurs in the Sierra La Laguana, San Francisquito Mts, and La Chuperosa, and on the summit of Socorro Island, and Revillagigedo Islands of Mexico, as well as Maui in the Hawaiian Islands. Hillebrand (1888) noted that the species grows only on eastern Maui "where the gregarious plant forms an interrupted belt round Haleakala at an elevation of 2000-3000 ft above the sea; most plentiful at Ulupalakua". Such a discontinuous distribution may indicate that *L. hastata* has been introduced to Hawaii (particularly as 36 of Epling's 38 taxa are either North or South American, and the Old World *L. stellata* (Cordem.) Epling from Reunion Island is known only as a fragmentary herbarium specimen in the Jardin des Plantes, Paris. If native to Maui, there may be an interesting problem to solve, in order to account for the distribution of the taxon. Hillebrand (1888) made the comment that the flowers are often attacked by a dipteran insect so that seeds are seldom found.

The native Hawaiian name for *L. hastata* is 'pakaha', but Neal (1965) does not mention the species being cultivated in Hawaiian gardens, nor does Kuck & Tongg (1958). Chittenden (1956), Bailey (1949), Robinson (1889) and Nicholson (n.d.) do not mention *L. hastata*, and to our knowledge its garden merit has not hitherto been acknowledged. It is a good subject for the back of a sunny herbaceous border, having decorative leaves when vegetative, resembling those of *Salvia canariensis* L., although larger. In late autumn or early winter it bears distinctive but not showy inflorescences, at a time when there is a dearth of flowering material in gardens, at least in South Australia. It is most likely frost tender. After flowering, the old shoots are cut back to ground level in order to induce a new flush, but otherwise the plants receive no special treatment. The only other species of *Lepechinia* mentioned in horticultural literature are *L. salviae* (syn. *Sphacele lindleyi* Benth.), *L. chamaedryoides* (Balbis) Epling from Chile (syn. *Sphacele campanulata* Benth.), and the Californian *L. calycina* (Benth.) Epling, but none are common. Perhaps one objection to *L. hastata* is its heavy pungent smell, as noted by Hillebrand (1888), persisting like that of rosemary.

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Brian Morley,
Botanic Garden
Adelaide.

Del. L. Dutkiewicz,
Botanic Garden,
Adelaide.

CORRIGENDA

J. Adelaide Bot. Gard. 1(1) (1976).

Page 35, line 13: read '*angustifolia*' not '*augustifolia*'.

J. Adelaide Bot. Gard. 1(2) (1977).

Page 70, lines 16 and 17: delete 'west of the River Murray'.

Page 79, after line 3: insert

'ca. ½ mile east of Trig Point, AD (2 sheets). *Blaylock 1066*, 13.x.1968, 8 km SSW of Corny Point Lighthouse.'

Page 80, line 6: replace with

'ed. 2) 20b (1942) 252, nomen sine descriptione latine. Fig. 6.'

The combinations *Stackhousia* Sect. *Stackhousia* § *Cincinniferae* Mattf. (1942) and § *Racemosae* Mattf. (1942) are invalidly published as Mattfeld did not provide a Latin description. It is also noted that the method of applying rank to taxa without clear indication of rank has been modified under *Article 35* (ICBN) — see *Taxon* 25 (1976) 171.

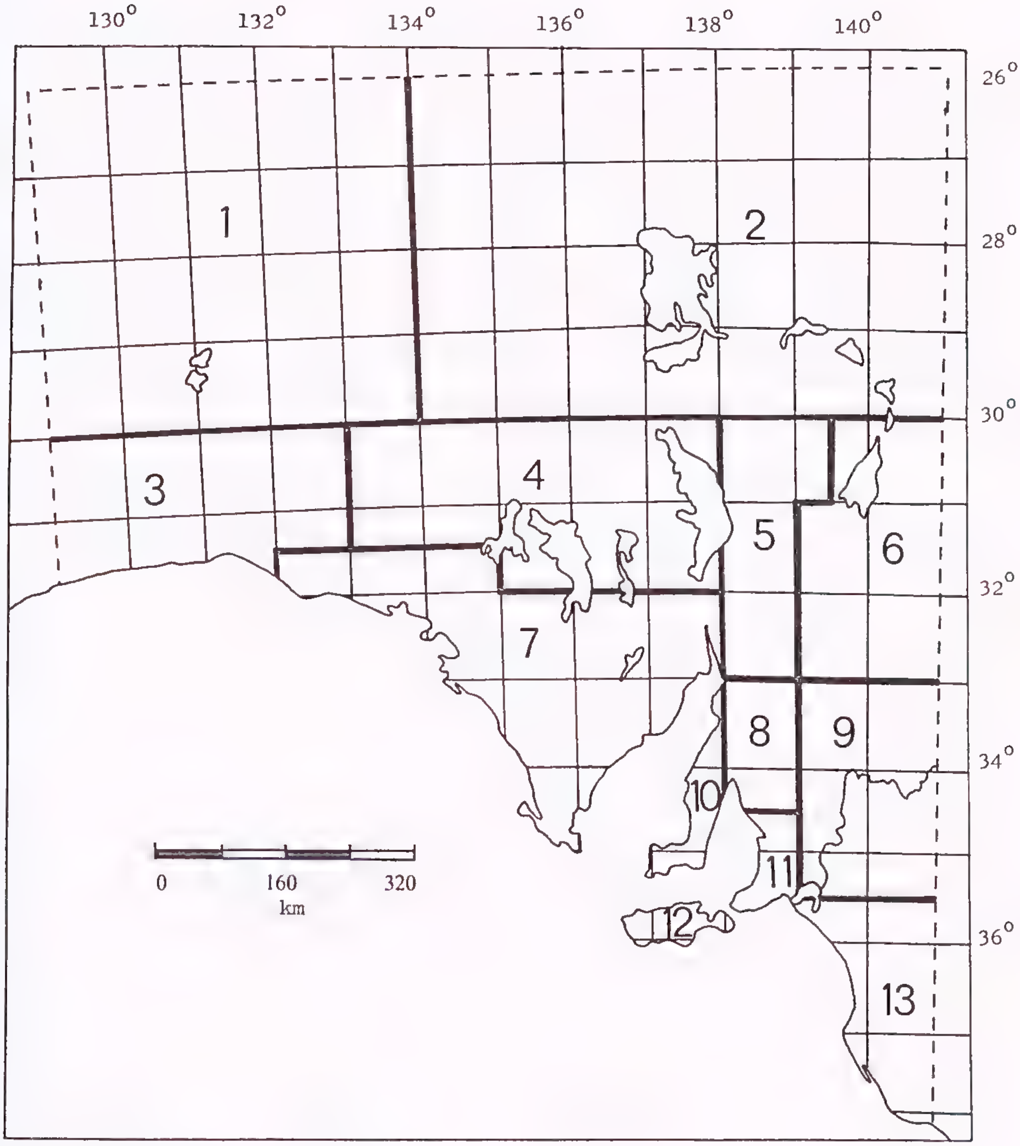
It is the author's intention to name and describe formally the relevant infrageneric taxa in a future generic revision.

Page 80, line 32: insert

'probably' after 'Musgrave Park, AD)'.

REGIONS OF SOUTH AUSTRALIA ADOPTED BY THE STATE HERBARIUM — ADELAIDE

1. North-western
2. Lake Eyre Basin
3. Nullarbor
4. Gairdner-Torrens Basin
5. Flinders Ranges
6. Eastern
7. Eyre Peninsula
8. Northern Lofty
9. Murray
10. Yorke Peninsula
11. Southern Lofty
12. Kangaroo Island
13. South-eastern



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JOURNAL of the ADELAIDE BOTANIC GARDENS

CONTENTS

JOURNAL of the ADELAIDE BOTANIC GARDENS

Volume I Part 4

2 April, 1979

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Papers will be accepted in the following categories:

(a) Plant systematics (Australian and horticultural groups); (b) Descriptive plant morphology, anatomy and ecology; (c) Obituaries, biography and history; (d) Bibliographic studies, book reviews; (e) Botanical illustrations; (f) Noteworthy horticultural contributions.

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Manuscripts must be typed, with double spacing and margins at least 3 cm wide, on one side of the paper only. Three copies must be submitted. Captions must not be italicized, underlined or typed in capitals. All scientific names of generic or lower rank must be underlined.

The print area for illustrations is 20 x 13 cm (including captions). Half-tone material should be submitted this size if possible, but will be reduced by the printers, if necessary.

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The pattern of the paper should generally be:

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References

Text references to publications should be indicated as follows: (Smith, 1959), (Smith, 1959, p. 127), Smith (1959) or Smith (1959, pp. 125-208). The final section of the paper, headed 'References', should include only those titles referred to in this way. It should be laid out as follows:

Smith, K. L. (1879). The species of *Danthonia* found in pastures in Victoria. *Austral. J. Bot.* 65: 28-53.

Bentham, G. (1868). "Flora Australiensis", Vol. 4. (London: L. Reeve.)

Baker, J. G. (1898). Liliaceae. In Thiselton-Dyer, W. T. (ed.), "Flora of Tropical Africa", Vol. 7 (Ashford: L. Reeve).

Journal abbreviations must be consistent within a paper and authors are recommended to follow "Botanico-Periodicum-Huntianum". Journals not cited in B-P-H should be abbreviated to conform with this general pattern. The following abbreviations for Australian states should be used: WA, NT, SA, Qld, NSW, ACT, Vic., Tas.

Text references to specimens should be italicized, for example *Koch 276*.

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When required, follow the pattern on, for example, p. 106 of vol. 1, pt. 2.

Recommendations on taxonomic papers

Synonymy

Authors are requested to include in the synonymy only references to publications containing information additional to that to be published in the paper being submitted. Within this section journal and book titles must be consistently abbreviated. B-P-H journal abbreviations and book titles abbreviated in a similar way are desirable. Authors of references cited in the synonymy should be abbreviated.

References may be cited as:

Benth., *Fl. Austral.* 4: 111 (1868) OR
Benth., *Fl. Austral.* 4 (1868) 111.

Citation of specimens

10-30 specimens should be cited for each species (or subspecific taxon), although this may be varied under certain circumstances. The author may decide whether or not to include dates of collections and the sequence, provided a constant pattern is adhered to throughout a paper.

Authors wishing to cite all specimens seen may list them all in an index to collectors after the style of the "Flora Malesiana" identification lists. Collections not identifiable by a collection number (assigned by either the collector or herbarium) should cite dates.

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TWO NEW TAXA OF *PTILOTUS* (AMARANTHACEAE)

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Abstract

Two new taxa of *Ptilotus* are described, *Ptilotus maconochiei* Benl sp. nov. from Queensland and *Ptilotus aristatus* var. *stenophyllus* Benl var. nov. from the Northern Territory.

Descriptions

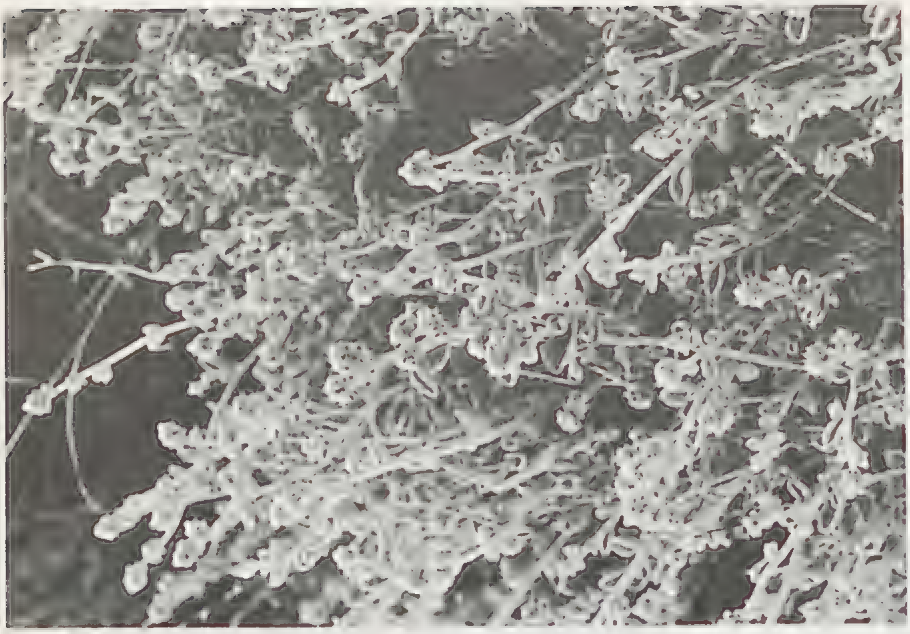
Ptilotus maconochiei Benl, sp. nov., *Pt. royceano* Benl affinis, a quo praecipue recedit habitu erecto, ramis nec arcuatis nec dependentibus, foliis carnosis maioribus haud orbicularibus, spicis confertifloris conoideis dein elongati-ovoideis, haud laxifloris.

Typus: Queensland; Mt. Isa, City Lookout, ca 570 m alt.; coll. *Benl (Au 64) & Maconochie,* 8.iii.1978 (holotypus M; isotypi AD, ADW, B, BM, BRI, CANB, DNA, K, M, MEL, NSW, NT, NY, P, PERTH).

Tufted *shrub* (Fig. 1, a) to 80 cm tall and 80 cm or more across, with homogenous tomentose indumentum on stems and leaves. The tomentose vestiture of vegetative parts composed of fine white, crisped, densely intricate hairs, ca 1 mm long, slightly articulate and twisted, less dense on fully developed leaves than on shoots, the former showing prominent venation underneath; the many erect *stems* (to 1 cm diameter at their grey to light-brown base) arising from a stout woody rootstock; numerous divergent branches and branchlets 10-30 cm long, clothed with soft white indumentum when young, bearing leaves all along and with spikes both terminal and axillary, towards the apex (Fig. 1, b). *Leaves* alternate, 0.4-2.5 (-4) cm distant, erect-spreading, spathulate-obovate or broadly elliptical, thick, fleshy, whitish to dark grey or greyish-green becoming brownish when withering, persistently puberulent on both sides; blade entire, 0.8-2 (-2.5) x 1-1.5 (-1.8) cm. apex blunt-pubescence mostly covering a minute excurrent mucro, slightly attenuate at base into a short, white, woolly petiole to 5 mm long. Uppermost leaflets grading into bracts.

Flower spikes compact (Fig. 1, b), borne terminally on branches and branchlets as well as in the upper (in part defoliate) leaf axils, subsessile or shortly pedicellate, pedicels 1-3 mm long, conoid to elongate-ovoid, 0.7-1.2 x 0.8-1.1 cm, rarely cylindrical and to 3 cm long, with 15 to 30 shortly stalked, fluffy flowers, tightly arranged; dull pink when fresh, soon losing their colour and becoming inconspicuous. Floral bract and bracteoles subacute, faintly keeled with a light-brown prominent midrib, on the dorsal side the surface almost obscured by the dense pubescence and the woolly flexuose hairs of the rachis. Bract (Fig. 2, a) broadly ovate, 2-2.5 x 1.5 mm, clothed with and exceeded (at top as well as on the irregularly denticulate margins) by more or less straight to more or less curved or crisped remotely nodose hairs to 2 mm long. Bracteoles smaller, ca 1.8 x 1.3 mm, subovate-concave, membranaceous, adpressed to perianth, less hairy and transparent on both edges (Fig. 2, b). *Perianth* purplish turning pink, green in lower portion; surrounded at base by a dense ring of short rigid hairs; outer surface plumose except near the apex; the hairs spreading to 1.2 mm long. Perianth segments free, their thickened base forming a pseudotube 0.4-0.5 mm long, somewhat keeled by midrib; inner side (Fig. 2, c) with three conspicuous nerves, the outer of which more or less bordering a reddish, turning green, median areola. Outer perianth segments sublinear, about 4.5-5 mm long, to 1 mm across, the apex finely denticulate, margins often abruptly curved inward 0.25-0.35 mm below tip, the tip made appendage-like (Fig. 2, c); glabrous within. Inner segments ca 4.5 x 0.8 mm, lanceolate, usually tapering gradually into apex which may be reached but not exceeded by dorsal vestiture; often showing near the base some internal crisped hairs arising mostly from the edges. *Stamens* 5, all fertile; united to a 3.5-4.5 mm high membranous, glabrous cup, only basally attached to

a.



b.

Fig. 1. *Ptilotus maconochiei* Benl: a, shaly slopes of Mt Isa City Lookout (ca 570 m alt.) covered with more than one hundred shrubs (40-80 cm tall) of the hitherto undescribed species; photo A.S. George. b, branches and branchlets bearing compact spikes up to 3 cm long; photo J.R. Maconochie.

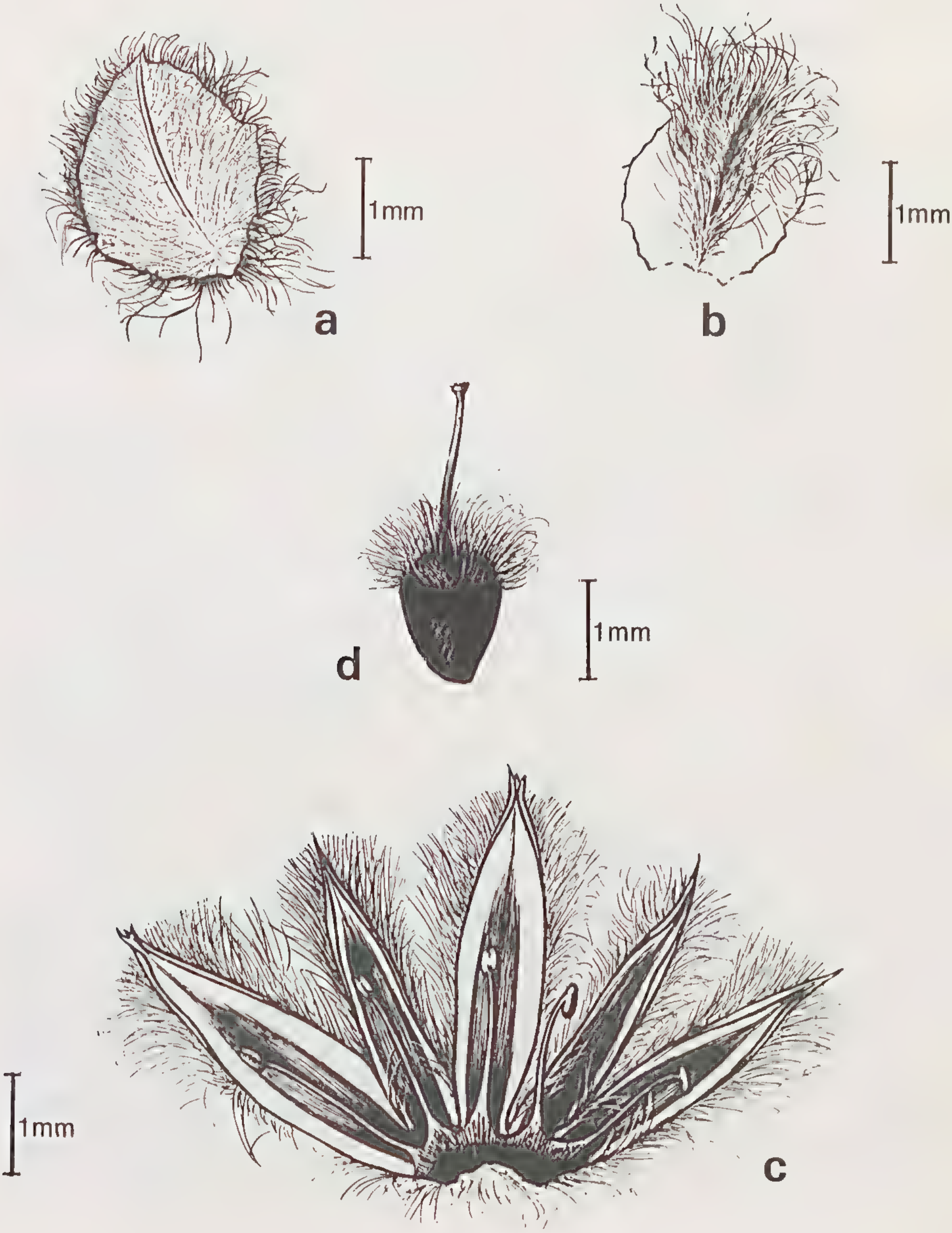


Fig. 2. *Ptilotus maconochiei* Benl: a, bract, inner view; b, bracteole, outer view; c, perianth cut open, inner view; d, pistil (drawn by A. Böhm).

the perianth segments; pseudo-staminodes absent. Filaments narrowly ligulate, almost equally long from 2 to 2.5 mm, subulate above, dilated to 0.3-0.45 mm below; anthers ellipsoid, ca 0.35 x 0.2 mm. *Ovary* turbinate, finally sub-globose, 1.2-1.5 mm diameter, sessile, remarkably pilose in upper portion, hairs at first straight then woolly; style central, 1.8-2 mm long, glabrous except for its base; stigma inconspicuous.

Specimens Examined

QUEENSLAND: Burke District, Mt Isa city, main lookout (20°44'S, 139°30'E): *Bishop s.n.*, hillside, shale and rocky soil, 2.viii.1969 (BRI); l.c., *Mason s.n.*, 1975 (BRI); — both specimens are represented by small fragments and erroneously determined as *P. royceanus* Benl; *George 12908* l.c., on rocky hillside, 9.iv.1975 (M. PERTH).

Discussion

There is a considerable likeness of the present plant to *Ptilotus royceanus* as regards floral structure, but not with regard to the inflorescence, which in *P. royceanus* is an elongated, interrupted spike. The latter species is known from some ranges in the Australian desert, near the Western Australian-Northern Territory border, where it seems to be dependent on vertical rock walls with fissures and crevices.

An appendage-like extremity of the outer perianth segments may also be found in *P. mollis* Benl (see J.R.Soc.W.Aust.53: 5, Fig. 3, d), a species with crowded spikes like those of our new plant, but characterized among other things by a markedly different silky pubescence of the leaves giving them a peculiar silvery-grey cast.

Thus, whilst *P. royceanus* remains unique with its hanging branches, usually orbicular leaves and its loose-flowered inflorescences, *Ptilotus maconochiei* is sharply separated from other xerophytic taxa with a densely tomentose coat.

This species is named in honour of Mr John R. Maconochie, Senior Botanist in the Herbarium of Northern Territory, Arid Zone Research Institute, Alice Springs. Mr Maconochie and I had the opportunity to look for and collect this interesting *Ptilotus* at Mt Isa, where it seems to be endemic.

Stimulated by a conversation with Mr George and by the scanty material in the Queensland Herbarium we made a collecting trip to Mt Isa and there counted more than one hundred shrubs of the new taxon growing in full flower on the shale hillslope of the City Lookout, between 550 and 570 m altitude.

Ptilotus aristatus Benl, var. **stenophyllus** Benl, var. nov., differt a varietate typica foliis laete viridibus, lanceolatis, omnibus valde angustioribus.

Typus varietatis: Northern Territory; Mt Hay, Milton Park. "Mitchell grass plains in the SW. foothills. Moderately common. Erect, flowers purple." — *Griffin s.n.*, 23.x.1974 (holotypus CANB, isotypus NT).

Leaves uniformly green, the basal ones ca 5 mm broad, lower and medium cauline leaves 1.3-3 mm broad. In var. *aristatus* the glaucescent leaves (which may be reddish-tinged like the stem) are to 18 mm (basal) and 10 mm (cauline) broad respectively.

The holotype displays 20 bright green stems, densely tufted and to 25 cm long. Radical leaves are long-petioled, to 3.7 cm, the cauline ones more or less acicular. Flower-colour is deeper than in the specimens hitherto known of var. *aristatus*.

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APIUM L. SECT. *APIUM* (UMBELLIFERAE) IN AUSTRALASIA

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Abstract

Apium in Australasia is reviewed and three species, *A. prostratum* Labill. ex Vent., *A. insulare* Short sp. nov. and *A. annuum* Short sp. nov. occur naturally in the region. A fourth species, *A. graveolens* L., the cultivated celery, occasionally occurs as a weed. *A. prostratum*, widespread throughout the region, is divided into three subspecies, ssp. *prostratum*, ssp. *howense* Short ssp. nov., restricted to Lord Howe Island, and ssp. *denticulatum* Short ssp. nov., confined to the Chatham Islands. A single collection from the Porongorup Range, Western Australia, is also tentatively regarded as representing a separate subspecies of *A. prostratum*. Two varieties of ssp. *prostratum*, namely var. *prostratum* and var. *filiforme* (A. Rich.) Kirk are distinguished. Both varieties occur in Australia and New Zealand. *A. annuum*, the only annual in the genus, is confined to Australia. *A. insulare* occurs on Lord Howe Island and islands of Bass Strait. *A. australe* Pet.-Thou., to which Australasian populations have often been referred, is not considered to occur in the region.

Introduction

Apium L. currently contains approximately twenty species, with five occurring in Europe (Tutin 1968) and most of the remaining species in South America. Australasian floristic literature commonly records four species, *A. graveolens* L. the cultivated species, the weed *A. leptophyllum* (Pers.) F. Muell. considered here to belong to the genus *Ciclospermum* Lag., and the natives *A. prostratum* Labill. ex Vent and *A. filiforme* (A. Rich) Hook. It has long been considered that the native Australian (e.g. Bentham 1876; Curtis 1963; Eichler 1965) and New Zealand (e.g. Hooker 1867; Kirk 1899; Allan 1961) populations of *Apium* exhibit a great diversity of form. This paper is an attempt to provide a workable and nomenclaturally correct classification of the populations of *Apium* that occur in Australia, New Zealand and neighbouring islands.

History

A. *Generic History*

Linnaeus (1753) in his 'Species Plantarum' described two species of *Apium*, *A. petroselinum* (= *Petroselinum crispum*) and *A. graveolens*, and subsequently described the genus in his 'Genera Plantarum' (1754). Since the time of Linnaeus the genus *Apium* has been variously defined and sub-divided by De Candolle (1830), Bentham (1867a), Drude (1898) and Wolff (1927). The most recent comprehensive world-wide treatment of *Apium* is that by Wolff (l.c.), who recognized 5 sections; sect. *Apium* containing, among others, *A. prostratum* Labill. ex Vent., *A. filiforme* (A. Rich.) Hook and *A. graveolens* L., sect. *Ciclospermum** (Lag.) Wolff which contained all annual species, sect. *Mauchartia* (DC.) Benth. sect. *Oreosciadium* DC. and sect. *Apodicarpum* (Makino) Wolff.

Since Wolff's 1927 revision of *Apium* the generic limits of the taxon have been revised by several workers.

Mathias & Constance (1951) transferred all members of sect. *Oreosciadium* DC. to the genus *Niphogeton* Schldl. This genus is restricted to the Andes of South America.

* Wolff and other past workers have used the spelling *Cyclospermum* but the original spelling as used by Lagasca (1821, n.v., fide Index Nominum Genericorum) is *Ciclospermum* and this should be retained. It could be argued that the spelling *Cyclospermum* is justified as Lewis & Short (1962) use the spelling cyclas in their classical Latin dictionary and, furthermore, article 73, note 2, of the International Code of Botanical Nomenclature (Stafleu et al. 1972) does say that the consonant y is permissible in Latin plant names. However, the same article also states that "the liberty of correcting a name is to be used with reserve, especially if the change affects the first syllable and, above all, the first letter of the name".

MacBride (1930, n.v., fide Mathias & Constance (1951)) also felt that sect. *Helosciadium (= Mauchartia)* may, from a genetic standpoint, be closely related to *Sium* L. and perhaps should be given generic status. However, there appears to have been no further investigation of this question.

Hiroe & Constance (1958), Mathias & Constance (1962) and Ohwi (1965) also regard sect. *Apodicarpum* (Makino) Wolff as being generically distinct. *Apodicarpum* Makino is a monotypic genus endemic to Japan.

In 1962 Mathias & Constance recognized a need for revision of section *Ciclospermum* (Lag.) DC. and suggested that this variable group of annuals could be given generic status. Cerceau-Larrival (1964), primarily on the basis of pollen and cotyledon characters and different chromosome numbers (n = 7 in *A. leptophyllum*, n = 11 in species belonging to other sections of *Apium*) placed *A. leptophyllum* in the genus *Ciclospermum* Lag. She makes no mention of the placement of the other South American annuals, *A. laciniatum* (DC.) Urban and *A. uruguayense* Mathias & Constance, but since they have previously been included in sect. *Ciclospermum* (Lag.) DC. by Wolff (l.c.) and Mathias & Constance (1962), they may be found to belong to *Ciclospermum* as suggested by a haploid chromosome number of n = 7 found in *A. laciniatum* (Bell & Constance 1957).

Surprisingly, despite Cerceau-Larrivale's placement of the annual species in *Ciclospermum* and previous suggestion of this action by Mathias & Constance (1962), Constance, Chuang & Bell (1976) still included *Ciclospermum leptophyllum* (Pers.) Sprague in *Apium*.

For the purposes of this investigation of *Apium* in Australia I have accepted the recent modifications proposed to Wolff's 1927 system. Thus sect. *Apium* and sect. *Mauchartia* [DC,] Benth are the only two sections which I recognize within *Apium*. The Australian species *A. prostratum* and the cultivated celery *A. graveolens* belong to section *Apium*, while the weed *A. leptophyllum* is treated as belonging to the genus *Ciclospermum*.

B. *Taxonomic History of Native Australasian Species*

Ventenat (1804-5) first described the species *A. prostratum* Labill. ex Vent. in the "Jardin de la Malmaison". He applied the name previously published as a nomen nudum by Labillardiere (1800). Several years later Du Petit-Thouars (1808-11) described the species *A. australe* in the "Esquisse de la flore de l'Isle de Tristan d'Acugna". Many of the Australasian floras (Black 1962; Allan 1961) and Wolff (1927) do in fact cite the publication date of *A. australe* as 1804 and this name has often been considered to be nomenclaturally correct by workers who believed the two species *A. prostratum* and *A. australe* to be conspecific. Stafleu (1967), and Stafleu & Cowan (1976), however, cite the correct publication date for the "Esquisse" as being 1808, the paper being reprinted or re-issued in 1811. Dr. A. Kanis (pers.comm.1976, then Australian Botanical Liaison Officer at Kew) has, apart from an unsupported reference by van Steenis-Kruseman (1964) which was referred to by Stafleu (l.c.), and Stafleu & Cowan (l.c.), found no evidence that there was an edition of this paper in 1808. Kanis considered that if there was an 1808 edition then the 1811 edition was likely to be verbatim.

While *A. australe* has been considered by most workers to be the same as *A. prostratum*, others (e.g. Eichler 1965) have expressed doubt that this is indeed so. Irrespective of whether *A. prostratum* and *A. australe* are conspecific the correct name for the Australian species, because of its prior date of publication, is *A. prostratum*.

Robert Brown, in an unpublished manuscript of his Australian collections, described *A. prostratum* from collections made in December 1801 from King George III Sound, Western Australia. On the basis of leaf type he recognized two varieties, one with 3-4 pinnatifid cauline leaves with linear undivided segments and the other with leaves with linear-oblong or entirely oblong "pinnules". Other workers, (e.g. Bentham 1867b; Hooker 1856), were also well aware of the variation in leaflet shape exhibited by *A. prostratum* and in 1927 Wolff

formally divided *A. prostratum* into two varieties, var. *latisectum* Wolff possessing leaflets with broadly obovate or cuneate segments, and var. *angustisectum* Wolff, having leaflets with linear or lanceolate segments. The former variety was considered to occur in South America, Australia, New Zealand and Lord Howe Island, the latter in Australia and New Zealand. In 1929 Domin, without referring to Wolff's revision also distinguished two varieties of *A. prostratum,* namely var. *filiforme* (A. Rich.) Kirk (see below) and var. *maritimum* Domin. The latter variety was described from Australia and contained plants with obovate or obcuneate segments and more robust stems than those occurring in var. *filiforme.*

In 1832 Richard described the species *Petroselinum filiforme* from New Zealand. W.J. Hooker (1851) transferred *P. filiforme* to *Apium* and recognized two varieties, var. α with leaflets having lobes cut deeply and sharply, and var. β *trifidum* Hook. with less slender stems and entire leaflets lobes. However, in 1852 J.D. Hooker, although considering *A. filiforme* (A. Rich.) Hook. as a species, stated that this name applied to (p.87) "a much smaller and more slender plant than *A. australe* (= *A. prostratum*), of which I believe it to be probably a state, growing in rocky places, with smaller and less divided leaves". Kirk (1899) reduced *A. filiforme* to a variety of *A. prostratum* and this rank was also accepted by Cheeseman (1906). On the other hand both Wolff (1927) and Allan (1961) regarded *A. filiforme* as a distinct species.

Finally there are some unpublished records of interest. As stated above Robert Brown, in his unpublished manuscript, described the species *A. prostratum.* In the same manuscript, from collections made in December 1803 from the Kent's Island Group in Bass Strait, he described and named a species that differs from *A. prostratum* in leaf and floral characters. A Robert Brown collection from Bass Strait, housed in the National Herbarium of Victoria (MEL 503673), is of a single individual with a large erect stem and very large pedunculate compound umbel. (This specimen is referrable to the new species, *A. insulare* Short).

An examination of material housed in Kew and the National Herbarium of Victoria has shown that Ferdinand von Mueller gave unpublished varietal names to collections of annual plants which he considered to belong to *A. prostratum.* According to unpublished herbarium annotations, lists and correspondence, Dr Hj. Eichler (pers.comm.) has also recognized an annual *Apium* in South Australia as an undescribed species allied to *A. prostratum.* (These annual specimens of *Apium* are referrable to the new species, *A. annuum* Short).

Morphology

A. *Terminology*

Throughout this paper Stearn (1973) has been the major source of terminology, especially with respect to terms used to define leaf characters other than shape. For leaf shape the terms put forward by the Systematics Association Committee for Descriptive Terminology (1962) have been applied. Murley (1946) provided a glossary of terms used in describing fruit structures of the Umbelliferae and this has been followed.

B. *Techniques*

Chromosome counts of *A. annuum* were obtained by taking root tips from freshly germinated seeds (*Short 206*) and fixing them in a mixture of 3 parts ethanol: 1 part glacial acetic acid for two hours. Following this they were hydrolysed in 10% hydrochloric acid at 25°C for 15-20 minutes before being squashed and stained with aceto-orcein.

C. *Characters*

1. *Life Span and Habit*

A. annuum is a small (3-10 cm tall) annual that completes its life cycle in 3-4 months. Both *A. prostratum* and *A. insulare* are biennial or perennial species. *A. prostratum* is a large prostrate plant that may root at the nodes while *A. insulare* possesses a large, erect stem.

2. *Cotyledons*

A study of seedling morphology by Cerceau-Larrival (1971) has shown that in the Umbelliferae it is possible to distinguish 2 major types of cotyledons:

(a) Long (L) type- in which the lamina almost imperceptibly grades into a petiole
(b) Round (R) type- in which the lamina abruptly narrows into a petiole

In 1964 Cerceau-Larrival made use of this character when distinguishing between the genera *Apium,* with round cotyledons and consisting at that stage only of perennials, and *Ciclospermum,* characterized by long cotyledons and comprising solely annuals. The newly described annual, *A. annuum,* possesses the round cotyledons of *Apium,* supporting its placement in that genus. No differences were found to occur between the Australian native species in cotyledon characters.

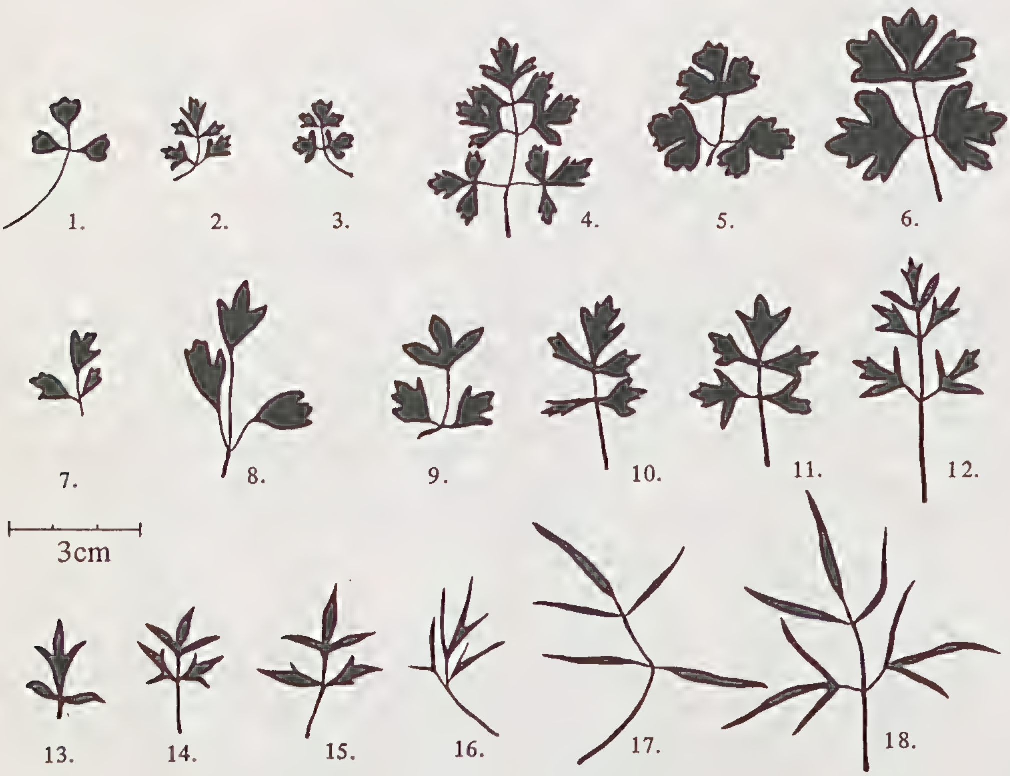

Fig. 1. *Apium prostratum* Labill. ex Vent. ssp. *prostratum,* variation exhibited in leaves opposite mature umbels; var. *filiforme* (A. Rich.) Kirk: 1, *Moore s.n.,* Cowan's Bay, Rodney County, New Zealand, 4.i.1962 (CHR 125562); 2-4, *Short 138,* Cape Lannes sand-dunes, South Australia, 5.iii.1976 (AD); 5, *Ritchie s.n.,* Sealers Bay, Codfish Is., off Stewart Is., 16.xii.1966 (CHR 174683); 6, *Short 82;* Port Elliot, South Australia, 17.ii.1976 (AD); 7, *Macmillan 67/5,* French Farm Bay, Akaroa Harbour, Banks Peninsula, New Zealand, 17.i.1967 (CHR); 8, *Talbot s.n.,* Rabbit Island, Tasman Bay, New Zealand, 13.xi.1962 (CHR 270576); 9, *Short 80;* Port Elliot, South Australia, 17.ii.1976 (AD); 10-11, *Short 60,* Port Elliot, South Australia, 17.ii.1976 (AD); var. *prostratum-filiforme:* 12, *Short 230,* ca. 1 km N. of Port Vincent, South Australia, 4.iv.1976 (AD); 13-15, *Short 303,* ca. 2 km S.W. of Gleeson's Landing, Yorke Pen., South Australia, 20.ii.1977 (AD); var. *prostratum:* 16, *Short 175,* Riddock Bay, South Australia, 5.iii.1976 (AD); 17, *Short 167,* Riddock Bay, South Australia, 5.iii.1976 (AD); 18, *Short 169,* Riddock Bay, South Australia, 5.iii.1976 (AD).

Fig. 2. *Apium prostratum* Labill. ex Vent. ssp. *prostratum*, variation exhibited in basal leaves. South Australian populations; var. *filiforme* (A. Rich.) Kirk: 1, *Short 118*, Robe sand-dunes, 5.iii.1976 (AD); 2, *Short 117*, Robe sand-dunes, 5.iii.1976 (AD); 3, *Short 81*, Port Elliot, 17.ii.1976 (AD); var. *prostratum-filiforme:* 4, *Short 214*, Port Vincent, 4.iv.1976 (AD); 5, *Short 208*, Port Vincent, 4.iv.1976 (AD); 6, *Short 303*, ca. 2 km S.W. of Gleeson's Landing, 20.ii.1977 (AD); 7, *Short 99A*, ca. 19 km N. of Policeman's Point, 4.iii.1976 (AD); 8, *Short 215*, Port Vincent, 4.iv.1976 (AD); var. *prostratum:* 9-10, *Short 171*, Riddock Bay, 5.iii.1976 (AD).

Inset: *A prostratum* Labill. ex Vent. ssp. *prostratum* var. *prostratum-filiforme*, variation exhibited in leaves opposite mature umbels of a single plant; *Short 213*, ca. 1 km N. of Port Vincent, South Australia, 4.iv.1976 (AD).

3. *Leaves*

To assist the analysis of leaf variation I have coined a number of terms to describe characters other than those outlined by Stearn (1973).

LEAFLETS (PRIMARY) — formed when a leaf is divided such that divisions extend to the petiole of the leaf.

LEAFLETS (SECONDARY) — formed when a leaflet is divided such that divisions extend to the petiolule resulting in primary segments which are in turn extensively divided.

SEGMENTS — primary: the major lobes of a leaflet — usually 3 — of approximately equal size.

secondary: the largest lobes of a primary segment — usually 3 — of approximately equal size.

tertiary: the result of divisions of secondary segments.

quaternary: the result of divisions of tertiary segments.

ULTIMATE NUMBER OF SEGMENTS — the total number of segments counting around the leaf margin, irrespective of whether they be of primary, secondary, tertiary or quaternary order.

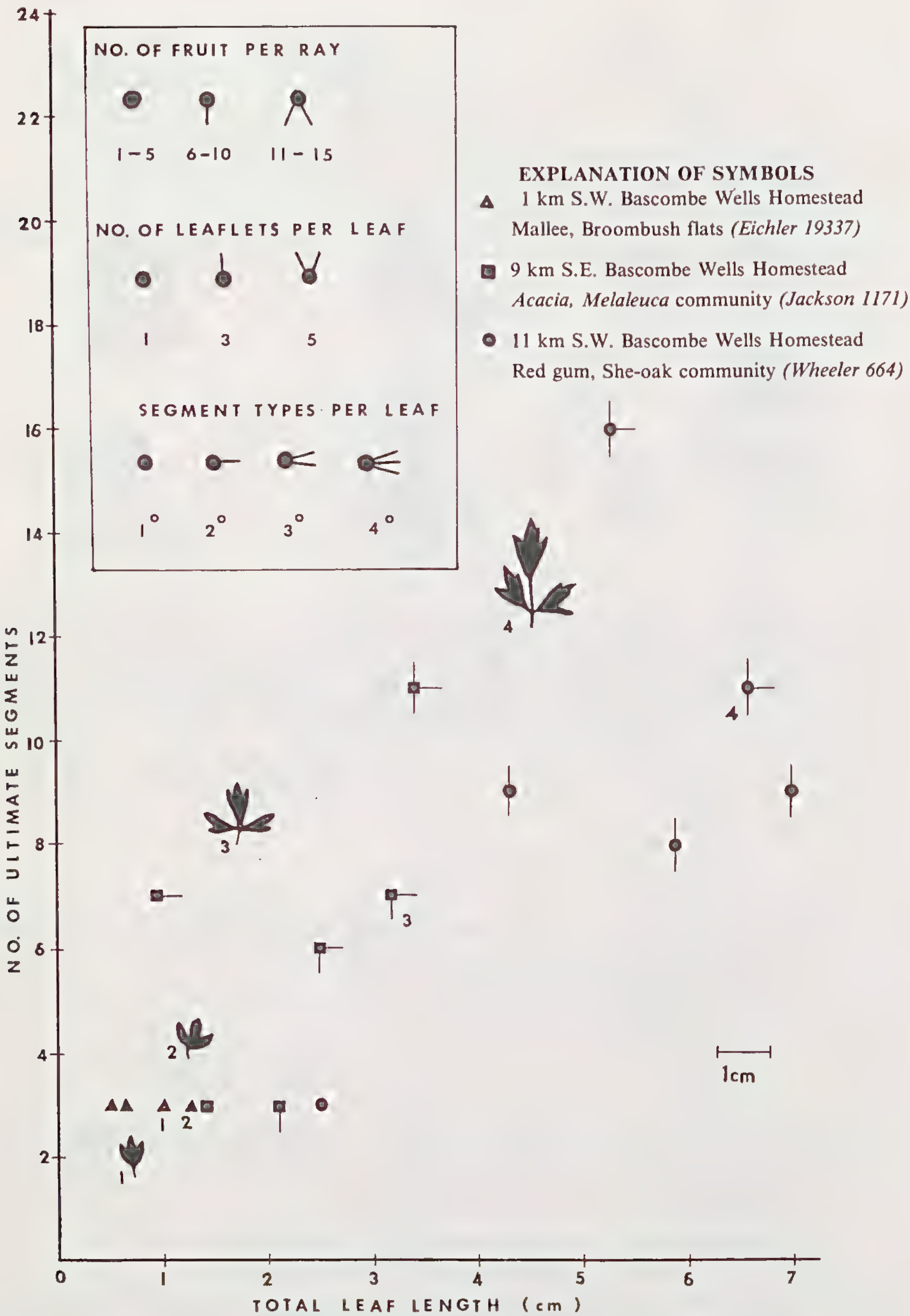

Fig. 3. Scatter diagram portraying the morphological intergradation between Hundred of Blesing (Eyre Penin.) populations of *A. annuum* Short.

A. prostratum Labill. ex Vent.

(a) ssp. *prostratum*

Investigations have shown that within individuals of *A. prostratum* ssp. *prostratum* it is usual for most basal and cauline leaves to differ from one another in the number and shape of leaflets. However, much of the apparent variations between these leaves occurs as the result of the longer persistence of the first 3-5 basal leaves, which tend to differ in shape more from the cauline leaves than from later formed basal leaves.

To enable comparisons of different plants to be made a "standard leaf", that opposite a mature umbel, was chosen. On any individual plant the shape of the leaflets and segments of this standard leaf barely differ, variation only occurring in the number of leaflets and segments per leaf. Similar variation generally occurs within any one population although I have observed a single individual (*Short 213,* Fig. 2, inset) from Port Vincent, South Australia, with quite different leaves to those normally found (Fig. 1 no. 12).

While the shape of the standard leaf is generally constant within populations and is, as indicated by growth experiments, primarily under genetic control, individuals from separate populations may exhibit differences in both shape and number of leaflets and segments (Figs 1-2). As can be seen in Figs 1 and 2 leaflet and segment shape is extremely variable and it is evident that there is a general intergradation of leaflet shapes. Studies in South Australia have in fact shown that an ecoclinal situation exists in populations belonging to *A. prostratum* ssp. *prostratum.*

The general consistency of leaflet and segment shape within South Australian populations of *A. prostratum* ssp. *prostratum* has provided the characters for the recognition of two varieties, namely var. *prostratum* with ± linear or lanceolate leaflets and/or primary segments (Fig. 1 nos 16-19) and var. *filiforme* (A. Rich.) Kirk with ovate, obovate, elliptic or ± cuneate leaflets and/or primary segments (Fig. 1 nos 1-11) in the standard leaf. Intermediate leaflet types are illustrated in Fig. 1, nos 12-15.

In New Zealand the species *A. filiforme* (A. Rich.) Hook. is generally considered to be distinct from *A. prostratum,* despite the fact that it recognized almost completely because of its possession of trifoliate leaves and that Allan (1961) recorded large numbers of intermediates between it and *A. prostratum*. On the basis of the variation in the number and shape of leaflets known to occur in South Australian populations, largely the same as that observed in collections examined from New Zealand (CHR, WELTU) and described in Allan (l.c.), I believe the variation in ssp. *prostratum* to be similar in New Zealand to that which I have observed in South Australia.

(b) ssp *howense* Short ssp. *denticulatum* Short

Shape characters, and to a lesser extent, ultimate number of segments per standard leaf have been used to distinguish *A. prostratum* ssp. *denticulatum, A. prostratum* ssp. *howense* and one tentatively proposed but not formally recognized subspecies, ssp. A. from the Porongorup Ranges in Western Australia.

A. annuum Short

As in *A. prostratum* it is usual for the first produced leaves to differ from later leaves in shape and number of leaflets. However, in some collections (*Eichler 19337*) mature plants possess no more than 2-3 leaves, all being alike in size and shape. Within those individuals with more than one standard leaf the shape of the leaflets and lobes and the number of ultimate segments exhibit little variation. However, much variation in the shape and number of leaflets and ultimate segments occurs both within and between populations (Figs 3 and 4). The fact that environmental parameters greatly effect leaf characters is amply illustrated in Fig. 4, where seeds from coastal Yorke Peninsula plants (*Short 206*) were grown in the glasshouse in vermiculite and provided with an ample supply of a water/nutrient solution. Note that quaternary segments were produced under these conditions.

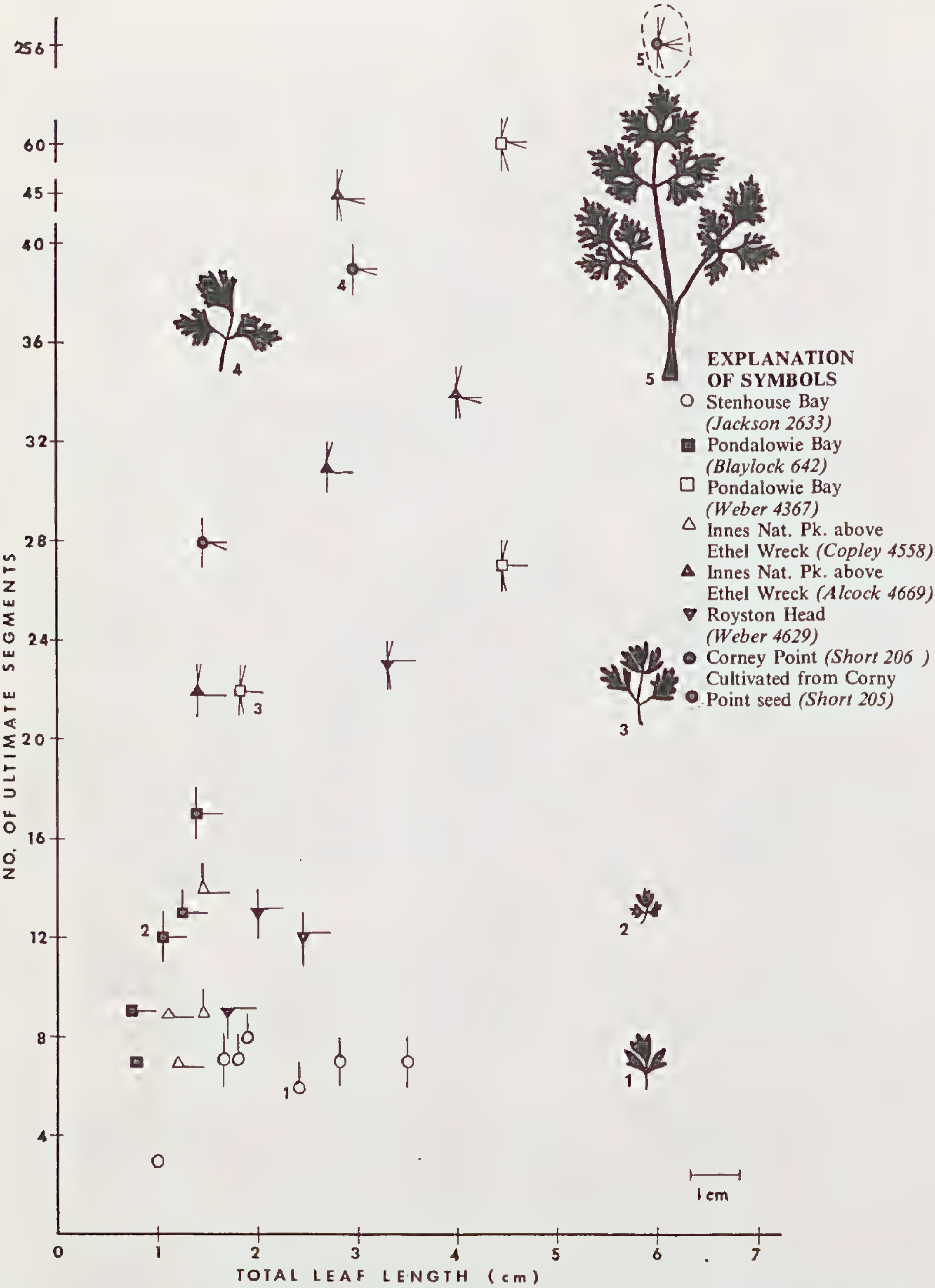

Fig. 4. Scatter diagram portraying the morphological intergradation between Southern Yorke Peninsula populations of *A. annuum* Short.

A. insulare Short

Insufficient material of this species was available to permit a study of the leaf variability. It was evident, however, that the standard leaf of this species generally possesses a larger number of ultimate segments and consistently differs by its broadly obovate leaflets in comparison with *A. prostratum* and *A. annuum*.

4. *Inflorescence*

All species of *Apium* have compound umbels. Individuals belonging to *A. annuum* and *A. prostratum* have either pedunculate or sessile compound umbels, with *A. prostratum* commonly possessing both types on one plant. *A. insulare* appears to possess only a very large pedunculate compound umbel.

The presence of involucral bracts and involucellal bracteoles in the inflorescence is diagnostically important in separating genera and sections in *Apium* sensu lato. Australasian species of *Apium* lack an involucellum, and usually an involucrum. However, a single bract has been rarely observed in some collections of *A. prostratum* and *A. insulare*.

5. *Pollen*

Studies by Cerceau-Larrival (1971) have revealed that the internal contour shape of a pollen grain is useful in distinguishing genera of Umbelliferae. Partly on the basis of the pollen morphology of *A. graveolens* and *A. leptophyllum*, Cerceau-Larrival recognized Wolff's section *Ciclospermum* (Lag.) Wolff as being sufficiently distinct to warrant generic status. Further pollen studies by Ferreira (1973) have supported this view.

In 1973 Ferreira described pollen of *A. australe* collected in South America and I have compared pollen from South Australian populations of *A. prostratum* with that of *A. australe*. The Erdtman (1952) method of acetolysis was used by Ferreira and this procedure was used for *A. prostratum*. No structural differences between the pollen of both species could be observed.

The scanning electron microscope was used to study pollen removed from herbarium material of *A. prostratum* and *A. annuum* but no gross morphological differences were found. This evidence supports the placement of *A. annuum* in *Apium* sect. *Apium* and not in *Ciclospermum*.

6. *Fruit*

The fruits of *A. annuum* and *A. prostratum* are markedly different. Mericarps of *A. annuum* are usually slightly concave on the commissural surface whereas this surface is flat in *A. prostratum*. The mericarps of *A. annuum* are also somewhat smaller than those of *A. prostratum* and have little thickening between the ribs. This last character is best seen in Figure 5 in which transverse sections of mericarps from *A. annuum, A. graveolens* and *A. prostratum* are shown. These figures also show that the size of the vascular bundles is somewhat larger in *A. prostratum* than *A. annuum*. The two species may also be distinguished on the basis of immature mericarps: in *A. annuum* the ribs are very small and rounded (Fig. 5D) whereas in *A. prostratum*, due to little thickening in the intervals, the fruit somewhat resembles the mature fruit of *A. annuum* (Fig. 5B).

The presence of very small ribs and large intervals in mericarps of *A graveolens* provide the best diagnostic character for distinguishing this species from *A. prostratum*. The fruit of *A. insulare* resembles those of *A. prostratum*.

7. *Chromosomes*

Cytotaxonomy in the Umbelliferae is still at the "alpha" level (Moore 1971), there being little information for this group other than recorded chromosome numbers. Moore (l.c.) has noted that chromosome number is of quite variable taxonomic use at the generic and specific levels with approximately one quarter of the genera showing some intra-specific variation.

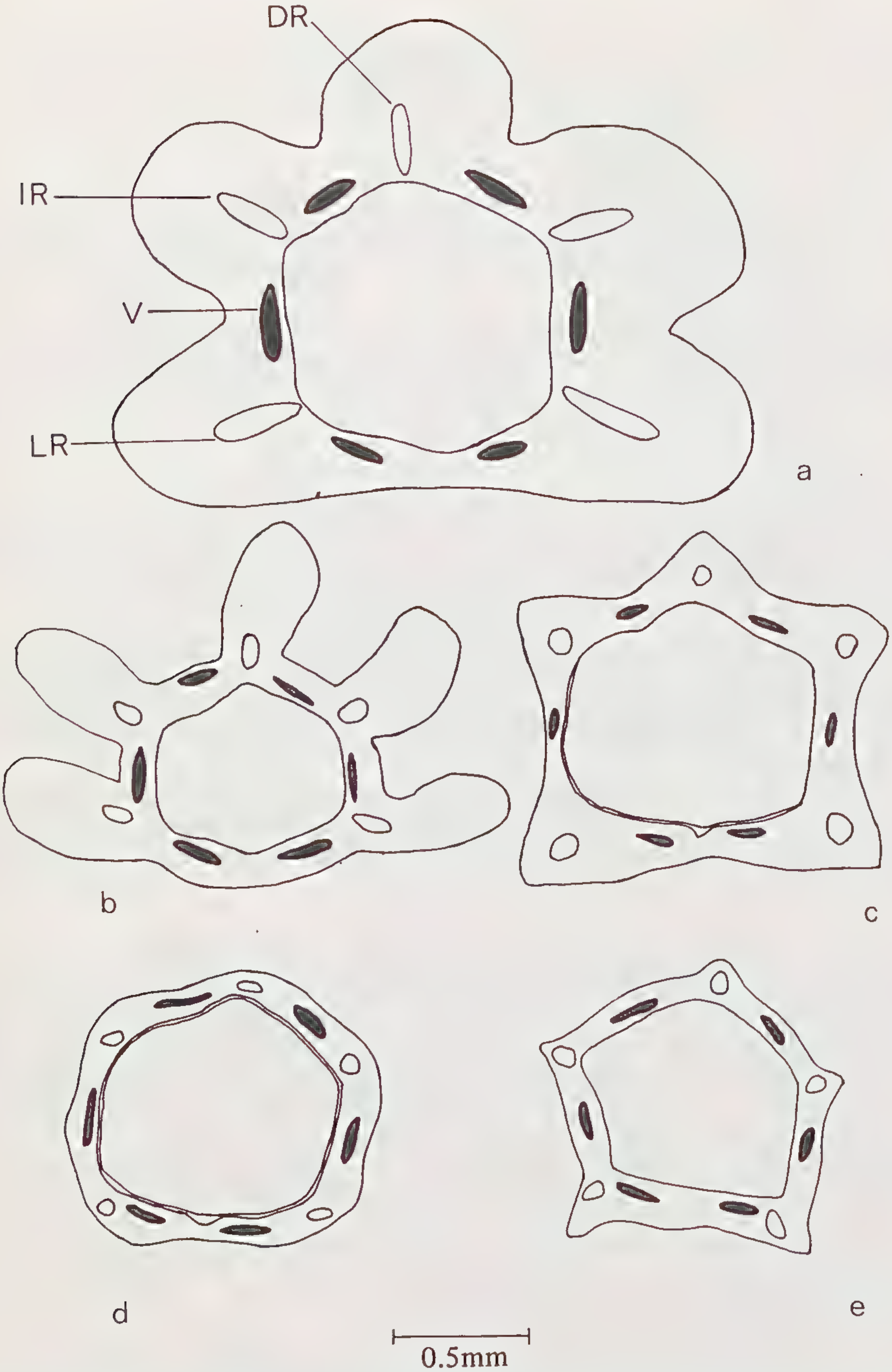

Fig. 5. Cross-sections of mericarps, A. *A. prostratum*, mature fruit (*Short 224*); B, *A. annuum*, mature fruit (*Short 206*); C. *A. annuum* ?, near mature fruit (*Eichler 17781*); D. *A. annuum*, immature fruit (*Alcock* AD 96932386); E. *A. graveolens*, mature fruit. Where DR = Dorsal rib bundle; IR = Intermediate rib bundle; LR = Lateral rib bundle; and V = Vitta.

Within *Apium,* counts have been made for a large number of species by Bell & Constance (1957, 1960, 1966), Beuzenberg & Hair (1963), Queiros (1972), Loeve & Kjellqvist (1974) and Constance, Chuang & Bell (1976). The results of this work are summarized in Table I. All species have n = 11, except for the two annuals, *A. leptophyllum* and *A. laciniatum* (DC.) Urban, which have n = 7. *A. leptophyllum,* partly because of this chromosome number, was placed in the genus *Ciclospermum* by Cerceau-Larrival (1964). The chromosome number of 2n = 22 recorded for *A. annuum* suggests that this species is rightfully placed in *Apium* rather than *Ciclospermum.*

Sharma & Bhattacharyya (1959) have constructed idiograms of *A. graveolens.* These are different from those constructed for *A. prostratum* by Beuzenberg & Hair* (1963); their idiograms of specimens belonging to *A. prostratum* var. *filiforme* show there to be little variation in the morphology of the chromosomes of individuals from different populations of this taxon.

Table 1. Chromosome numbers in *Apium* L.

Species	n =	2n=	Source
Sect. *Mauchartia*			
A. inundatum		22	Tutin 1975
A. nodiflorum	11	22	Queiros 1972 Loeve & Kjellqvist 1974 Constance & al. 1976
Sect *Apium*			
A. australe	11		Bell & Constance 1960; 1966 Constance & al. 1976
A chilense	11		Constance & al. 1976
A. aff. *chilense*	11		Bell & Constance 1957
A. commersonii	11		Constance & al. 1976
A. fernandezianum	11		Constance & al. 1976
A. graveolens	11		Constance & al. 1976
A. panul	11		Bell & Constance 1957; 1966 Constance & al. 1976
A. prostratum	11	22	Bell & Constance 1966 Beuzenberg & Hair 1963
A. sellowianum	11		Constance & al. 1976
A. annuum		22	Short unpublished
Sect. *Ciclospermum* (Lag.) DC. (= *Ciclospermum* Lag.)			
A. leptophyllum	7	14	Bell & Constance 1957; 1960 Queiros 1972 Constance & al. 1976
A. laciniatum			Bell & Constance 1957

* Beuzenberg & Hair published idiograms for *A. australe, A filiforme* and a hybrid specimen, *A. australe* x *A filiforme.* However, having examined their voucher collections it is clear that all their specimens belong to *A. prostratum* var. *filiforme.*

8. *Reproductive Biology*

(a) *Breeding Systems*

Vegetative reproduction occasionally occurs in *A. prostratum* ssp. *prostratum*, some plants in populations from Cape Lannes (*Short 131*) producing stolons. Plants that reproduce by this method still produce viable seeds.

(b) *Seed Dispersal*

Ewart (1908) recorded that some seeds of *A graveolens* were viable after a period of 13 months floating on sea water. If such resistance to seed damage by sea water occurs in *A. prostratum* and *A. insulare* then this would perhaps be a mechanism which explains the wide distribution of these species along the Australian coast-line. However, both *A. prostratum* and *A. annuum* also occur inland and water dispersal cannot be the only method of seed dispersal.

(c) *Hybridization*

The only substantiated record of hybridization in *Apium* occurs in sect. *Mauchartia* [DC.] Benth, Tutin (1975) recorded a hybrid between *A. inundatum* (L.) Reichenb. and *A. nodiflorum* (L.) Lag. The hybrid was found to flower much less freely than the parents and appeared to be completely sterile.

By using the double stain method outlined by Owczarzak (1952) pollen sterility tests were carried out on many individuals from populations of both *A. annuum* and *A. prostratum*. It was found that individuals examined from both species consistently had high percentages (much greater than 90%) of apparently functional pollen.

No evidence has been found to suggest that hybridization occurs between any of the Australasian species of *Apium*.

(d) *Phenology*

From observations in the field and information obtained from herbarium collections, it is evident that *A. annuum* flowers in late spring and early summer while *A. prostratum* flowers throughout the summer and even early autumn.

Taxonomy

APIUM L.

Apium L., Sp.Pl.(1753)264; Gen.Pl.(1754)83, n.238; DC.Prodr.4(1830)100, p.p.; Benth. in Benth. & Hook. f., Gen.Pl.1(1867)888, p.p.; Drude in Engler & Prantl, Pflzfam.3(1898)184, p.p.; Wolff in Engler, Pflanzenr.90(1927)32, p.p.
Lectotype (Hitchcock, Prop.Brit.Bot.(1929)142, n.v., fide ING): *A. graveolens* L., l.c. (Lectotype not *A. petroselinum* L. (= *Petroselinum crispum*) as designated by Britton & Brown, Illus.Fl.2(1913)642, vide ICBN (1972) Art.8).

Mauchartia Neck., Elem.1(1790)172, *nom.inval.* vide ICBN (1972) Art. 20(2).

Helosciadium Koch, Nova Acta Phys.-Med.Acad.Leop.-Carol.12(1824)125; DC., Prodr.4(1830)104, p.p.
Lectotype (Britton, Fl.Bermuda (1918)278, n.v., fide ING): *H. nodiflorum* (L.) Koch, l.c.

Terrestrial, aquatic or amphibious, annual, biennial or perennial *herbs;* glabrous, prostrate or erect and ascending. *Leaves* petiolate, with sheathing base, blade simply pinnate to ternately-pinnately compound; leaflets or segments widely elliptic to linear. *Inflorescence* leaf opposed, a sessile or pedunculate compound umbel; *bracts* absent or conspicuous;

bracteoles absent or conspicuous; *rays* ascending; *pedicels* ascending. *Flowers* bisexual: sepals 5 minute lobes or absent; *petals 5*, white or light greenish, ± ovate, inflexed at apex; *stamens* 5; *ovary* glabrous, stylopodium low-conic to depressed; *styles* 2, with terminal stigma, spreading or divaricate. *Fruit* a schizocarp, ovoid, ovoid oblong, globose or ovoid blobose, glabrous; *central axis* (carpophore) thick and shortly bifid; fruiting carpels (mericarps) 2, with prominent ± equal ribs, ± terete in transection; vittae solitary in the intervals, 2 on the commissure. *Chromosome number:* n = 11.

Distribution

About 20 species native to Europe, Asia, Africa, South America and Australasia. Four species occur in Australia, 3 indigenous and one naturalized.

Ecology

Species may be terrestrial, aquatic or amphibious.

Key to sections and species of *Apium* L. in Australasia

1a. Bracts generally absent, rarely one present; bracteoles always absent. Plants terrestrial. (Australasia, South America, Europe .... Sect. *Apium*

2a. Mature mericarps almost covered by prominent corky ribs which although divergent are adjacent to each other at the base, with seed wall barely apparent between ribs. Mericarps in radial longitudinal section with flat commissural surface. Plants biennial or perennial 3

3a. Plants prostrate with thin stems less than 0.5 cm in diameter; inflorescence of pedunculate and sessile compound umbels or sessile compound umbels only .... 1. *A. prostratum*

3b. Plants erect, with thick stem 0.5-1.0 cm diameter, inflorescence a pedunculate compound umbel .... 2. *A. insulare*

2b. Mature mericarps with thin ribs which are separate from each other, with seed wall apparent between ribs, the interval being approximately as broad or several times as broad as the ribs. Mericarps in radial longitudinal section with flat or concave commissural surface. Plants annual or biennial 4

4a. Plants annuals, stems short, to 10(15) cm long. Mericarps with width of the intervals at the seed face approximately equal to width of the ribs, in radial longitudinal section with concave commissural surface .... 3. *A. annuum*

4b. Plants biennials, erect to almost prostrate, stems longer than 30 cm. Mericarps with width of the intervals at the seed face several times width of the ribs, in radial longitudinal section with flat commissural surface. (Introduced species: not described) .... *A. graveolens*

1b. Bracts and bracteoles several. Plants aquatic or amphibious. (Euiasia and Africa; *A. nodiflorum* (L.) Lag. naturalized in New Zealand)* .... Sect. *Mauchartia* [DC] Benth.

1. **Apium prostratum** Labill. ex Vent., Jard. Malm. (1804/5) t.81; Labill., Relat. Voy. Perouse (1800)141, nomen nudum; Labill., Nov. Holl. Pl. Spec. 1(1805)76, t.103; Kirk, St. Fl. N.Zeal. (1899)196, p.p. (excl. South America, South Africa, Tristan da Cunha); T.F. Cheesem., Man. N.Zeal. Fl. (1906)205, p.p. (excl. Antarctic America, South Africa and Tristan da Cunha); Maiden, Proc. Linn. Soc. N.S.W. 23(1898)129, ? p.p. (excl. *A. insulare* Short); Laing & Blackwell, Pl. N.Zeal. (1907)454; Domin, Bibl. Bot. 89(1929)1048, p.p. (excl. Antarctic America); Beadle et al., Fl. Sydney Region (1972)396, -*Petroselinum prostratum* (Labill. ex Vent.) DC., Prodr. 4(1830)102; A. Rich., Fl. Nouv.Zel. (1832)278; Hook., Ic. Pl. 4(1840) t.205. - *Helosciadium prostratum* (Labill. ex Vent.) Bunge in Lehm., Pl. Preiss 1(1844/45)295.

Type: "Plant herbacee, annuelle, originaire de la Nouvelle Hollande, cultivee de graines rapportees par le capitaine Hamelin". *Holotype* P (photograph only seen); *Isotype* G (Herb. de Candolle ex microfiche IDC).

Petroselinum filiforme A. Rich., Voy.Astrolabe Bot., Fl.Nouv.Zel.(1832) 278. - *Apium filiforme* (A. Rich.) Hook., Ic.Pl.9(1852) t.819; Hook.f., F.N.Zel.(1852)87; Hook.f., Handb.N.Zeal.Fl.1(1867)90; Wolff in Engler, Pflanzenr.90(1927)33, (excl. South Africa) p.p., Allan, Fl.N.Zeal.1(1961)462.

*C.J. Webb, pers. comm. 1977.

Type: "Crescit in humidis Novae-Zeelandiae, locis dictis detroit de Cook, havre de l'Astrolabe" P (photograph only seen).

Apium australe auct. non Pet.-Thou.: Hook, f., Fl. N.Zel. 1(1852)86; Hook. f., Fl. Tasm. 1(1856)160, p.p. (excl. at least Tristan da Cunha); Hook. f., Handb. N.Zeal. Fl. (1864)90; Benth., Fl. Austral. 3(1867)372, p.p. (excl. *A. annuum* Short eg. Anon. MEL 503676, *A. insulare* Short, e.g. and Antarctic America, South Africa); F.M. Bailey, Queensl. Fl. (1900)724, p.p.; Rodway. Tasm. F. (1903)55, ? p.p. (as to *A. insulare* Short); Black, Fl. S.Austral. 1 ed. (1926)444, 2 ed. (1952)662, p.p. (excl. *A. annuum* Short e.g. Anon AD97619035 and Temperate South America); Wolff in Engler, Pflanzenr. 90(1927)33, p.p. (excl. South America); Ewart, Fl. Vict. (1931)907, p.p.; Blackall & Grieve, W. Aust. Wildfls. (1965)494.

Helosciadium australe auct. non (Pet.-Thou.) Bunge: Bunge in Lehm., Pl. Preiss. 1(1844/45)294.

N.B. For additional references see under synonymy of infraspecific taxa.

Terrestrial, biennial or perennial *herb,* glabrous, prostrate with branches (30)40-60(70) cm long, thin, less than 0.5 cm diameter. *Leaves* variable (for more detailed description see infraspecific taxa), those opposite compound umbels (2)4-9(14.6) cm long; leaflets primary or (in ssp. A) secondary, (3)5-7(11) in all, ± linear, ± lanceolate, elliptic ovate, obovate to oblanceolate in outline, entire or all with ± linear, ± lanceolate, ovate, obovate, elliptic or + cuneate primary segments, often secondary, tertiary and rarely quaternary segments present; ultimate segments (0) 6-50 (141), acute or obtuse; basal leaves (5.2)(6-15(40.5) cm long; leaflets similarly variable in outline to those of leaves opposite umbels. *Compound umbels* sessile or pedunculate; peduncle when present (0.2)0.5-1.5(2) cm long, ca. 1 mm diameter; bracts generally absent, occasionally one present; bracteoles always absent; rays (2)4-7(15) per inflorescence, (0.4)1-3.5(5.6) mm long. *Petals* white with yellow-brown mid-vein, ovate, (0.75)0.9-1.3(1.5) mm long, (0.5)0.5-0.7(1.0) mm wide, constricted at base, apex acute. *Stamens* less than or approximately the length of the petals, (0.55)0.6-0.8(1.0) mm long, filaments with ± yellow; anthers white ± yellow or purple, 0.3-0.4 mm long, 0.3-0.4 mm wide. *Ovary* glabrous, stylopodium disc like; style about equalling height of stylopodium, (0.25)0.3-0.35(0.4) mm long. *Schizocarp* obovate to orbicular, (1.3)1.5-2(2.5) mm long, (1.2)1.5-2.1(2.6) mm broad; carpophore very shortly bifid; mericarps in radial longitudinal section flat on commissural surface, hexagonal in transection, almost covered by prominent corky ribs with seed wall barely apparent between ribs; vittae large, solitary in the intervals, 2 on the commissure. *Chromosome number:* n = 11. Figs 1-2, 5, 9-12

Notes

1. Wolff (1927) considered the two species *A. prostratum* and *A. australe* Pet.-Thou. to be conspecific. On the other hand Bell & Constance (1960, 1966) and Constance, Chuang and Bell (1976) have referred to specimens from South America as *A. australe,* and Australian specimens as *A. prostratum.* Having seen a photograph of the type specimen (Fig. 8) and several other collections of *A. australe* from Tristan da Cunha *(Christophersen 445, 2419, 2421* and *Dyer 3568* — housed at K) it is evident to me that *A. australe* is a distinct species. Although I have seen few collections it appears that it can be easily distinguished from *A. prostratum* by the (a) erect, robust stem, (b) the large obovate leaflets on the majority of cauline leaves and (c) the more or less lanceolate leaflets and segments of the leaves surrounding the umbels.

2. In its natural coastal habitat celery, *A. graveolens,* displays vegetative characteristics not unlike those found in *A. prostratum.* In parts of South Australia *A. graveolens* has become established along the coast and unless mature fruits are available it is difficult to recognize this species as being distinct from *A. prostratum.*

The following key to the infraspecific taxa of *A. prostratum* is based on the characters of leaves opposite mature umbels.

Fig. 6. *A. australe* Pet.-Thou. Holotype (P).

Key to infraspecific taxa of *A. prostratum* (see Figs 1, 2, 9-12)

1a. Leaves with (0)10-40(74) ultimate segments to tertiary order. Leaflets of only primary or sometimes secondary orders present 2

2a. Primary segments of leaflets either trifid or tripartite with (0)3-9(10) secondary segments per leaflet. Leaflets 3, 5 or 7 3

3a. Leaflets entire or divided. Ultimate segments sometimes only primary order, sometimes up to tertiary order, number of ultimate segments (0)6-30(74) per leaf. Primary segments, when divided into secondary segments, (2)3.7-6.5(7) mm broad at point immediately below divisions forming secondary segments .... a. ssp. *prostratum* 4

4a. Leaflets entire or divided. Undivided leaflets and primary segments of divided leaflets ± linear or lanceolate with length (6)7-12(15) times the greatest breadth in outline .... a.1. var. *prostratum*

4b. Leaflets divided. Primary segments elliptic, ovate, obovate or ± cuneate with length (ca. 0.5) 2-3 times the greatest breadth in outline .... a.2. var. *filiforme*

3b. Leaflets always divided. Ultimate segments always up to tertiary order, number of ultimate segments 37-66 per leaf. Primary segments (1.0)1.1-2.5(3.6) mm broad at point immediately below divisions forming secondary segments .... b. ssp. *howensis*

2b. Primary segments or leaflets denticulate, with (6)10-20(36) secondary segments per leaflet. Leaflets 3-5 .... c. ssp. *denticulatum*

1b. Leaves with more than 100 ultimate segments to quaternary order. Leaflets of both primary and secondary orders present .... see *A. prostratum* ssp. "A"

a. ssp. **prostratum**

Leaves opposite compound umbels (3.3)4-9(13.4) cm long; primary leaflets only, (3)5-7 in all, entire or divided, ± linear ± lanceolate, elliptic, ovate, obovate or ± cuneate in outline, primary segments in divided leaflets commonly trifid to tripartite, sometimes entire, (2)3.7-6.5(7) mm broad measured immediately below divisions forming secondary segments; ultimate segments to tertiary order, (0)6-30(74) per leaf; *basal leaves* (5.2)5-15(40.5) cm long, leaflets (3)5-7(9), variously divided as in leaves opposite umbels.

Distribution (Figs 7,8)

The ssp. *prostratum* is found in coastal situations and inland throughout Southern Australia (extending little further north than Brisbane), Tasmania and New Zealand. Two ecotypically distinguished varieties, occur throughout the range of the subspecies.

Ecology

A. prostratum ssp. *prostratum* occurs in a wide spectrum of habitats, ranging from coastal sand dunes to brackish swamps and inland freshwater streams. The two varieties of *A. prostratum* ssp. *prostratum*, namely var. *prostratum* and var. *filiforme*, appear to be well defined ecotypically within this range (for details refer to ecological treatment under each variety).

This species flowers in the summer and early autumn.

Notes

1. The existence of two extreme leaf types has, along with ecological considerations provided the basis for the recognition of two varieties, var *prostratum* and var. *filiforme*. Few intermediate specimens, var. *prostratum-filiforme* (Figs 1, 2, 9) have been seen from Western Australia and New Zealand, but approximately 25% of specimens of ssp. *prostratum* examined from South Australia, Tasmania, Victoria, New South Wales and Queensland are perhaps best regarded as intermediates. This figure is approximate as, unfortunately many collections examined were inadequate, only a small portion of a plant being represented. For identification it is desirable to have entire, mature plants.

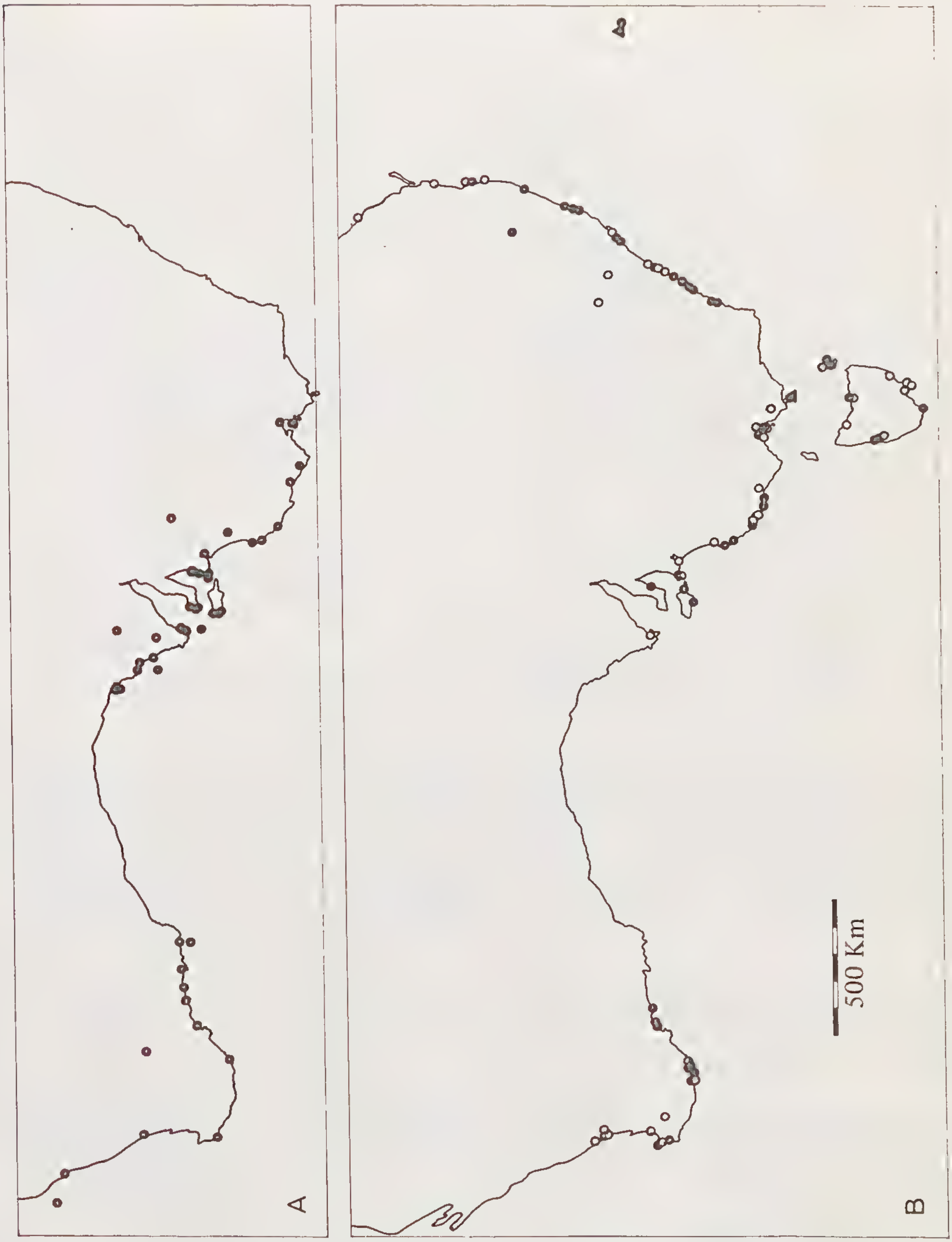

Fig. 7. Distribution of *Apium* in Australia and Lord Howe Island. A. *A. annuum* Short. B. *A insulare* Short (triangles); *A. prostratum* Labill. ex Vent. ssp. *prostratum* var. *prostratum* (circles); *A. prostratum* Labill. ex Vent. ssp. *prostratum* var. *filiforme* (A. Rich.) Kirk (dots).

a.1. var. **prostratum**

Apium prostratum Labill. ex Vent.,Jard.Malm. (1804/5) t.81; F. Muell., First Syst. Cens. Austral. Pl. (1882)63, p.p. (excl. *A. insulare* Short, *A. annuum* Short, *A. prostratum* var. *filiforme* (A. Rich.) Kirk); F. Muell., Key Syst. Vict. Pl. 2(1885)26, p.p. (as in preceding); F. Muell., Key Syst. Vict. Pl. 1(1887)269, p.p. (as in preceding); F. Muell., Sel. Extratr. Pl. (1888)40, p.p. (as in preceding); F. Muell., Sec. Syst. Cens. Austral. Pl. (1889)108, p.p. (as in preceding); C. Moore, Handb. Fl. N.S.W. (1893)221, p.p.: Hemsl., Ann. Bot. 10(1896)238, ? p.p.; Maiden, Proc. Linn. Soc. N.S.W. 23(1898)129 ? p.p.; Kirk, Stud. Fl. N.Zeal. (1899)196, p.p. (excl. *A. prostratum* var. *filiforme* (A. Rich.) Kirk and taxa from South America, South Africa, Tristan da Cunha; Maiden & Betche, Cens. N.S.W. Pl. (1916)162, p.p.; Domin. Bibl. Bot. 89(1929)104" p.p. (excl. Antarctic America); W.M. Curtis, Stud. Fl. Tasm. (1963)255, p.p. (excl. *A. ins 'are* Short and *A. prostratum* var. *filiforme* (A. Rich.) Kirk); Eichler, Suppl. to Black's ı l. S.Austral. (1965)252, p.p. (excl. *A. annuum* Short and *A. prostratum* var. *filiforme* (A. Rich.) Kirk); Beadle et al., Fl. Sydney Region (1972)396, p.p. (excl. *A. prostratum* var. *filiforme* (A. Rich.) Kirk); Willis, Handb. Pl. Vict. 2(1973)490, p.p. (excl. *A. insulare* Short, *A. annuum* Short and *A. prostratum* var. *filiforme* (A. Rich.) Kirk). — *Petroselinum prostratum* (Labill. ex Vent.) DC., Prod. 4(1830)102 p.p.; A. Rich., Fl. Nouv.Zel. (1832)278 p.p.; (as to Labill. citation); Hook., Ic. Pl. 4(1840) t.305 p.p. (excl. some collns of *Gunn 386*).

Apium australe var. *angustisectum* Wolff in Engler & Prantl, Pflanzenr. 90(1927)33; Allan, Fl. N.Zeal. 1(1961)463.

Type: None designated; lectotype will have to be chosen from material studied by Wolff. Wolff's specimens of this taxon housed at Berlin have been destroyed (Dr H. Ern, pers.comm., 1977).

Apium graveolens auct. non L. Hook. f., Fl. Antarct. 2(1846)287, p.p. (excl. Southern America, Falkland Is., Tristan da Cunha, Cape of Good Hope).

Apium australe auct.-non Pet.-Thou.; Benth., Fl. Austral. 3(1867)372, p.p. (excl. *A. annuum* Short, *A. insulare* Short, *A. prostratum* var. *filiforme* (A. Rich.) Kirk, *A. prostratum* ssp. *howense* Short; F.M. Bail., Syn. Queensl. Fl. (1883)212, p.p.; F.M. Bail., Queensl. Fl. (1900)724, p.p.; Rodway, Tasm. Fl. (1903)66, p.p. (excl. *A. prostratum* var. *filiforme* (A. Rich.) Kirk and *A. insulare* Short); F.M. Bail., Compreh. Catal. Queensl. Pl. (1913)229, p.p.; Black, Fl. S.Austral. 1 ed. (1926)444, 1 ed. (1952)662, p.p. (excl. *A. annuum* Short, *A. prostratum* var. *filiforme* (A. Rich.) Kirk, as to AD97619035); Ewart, Fl. Vict. (1931)1906, p.p.).

Apium australe var. β Hook. f., Fl. N.Zel. 1(1852)86, ? p.p.; Hook. f., Fl. Tasm. 1(1856)160; Hook. f., Handb. N.Zeal. Fl. 1(1867)90.

Apium prostratum var. β T.F. Cheesem., Man. N.Zeal. Fl. 1 ed. (1906)205, 2 ed. (1925)657.

Leaves opposite umbels with leaflets entire or divided with primary segments or divided leaflets or entire leaflets ± linear or ± lanceolate, with a length (6)7-12(15) times the greatest breadth; ultimate segments usually primary, rarely to secondary order, (0)4-12(20) per leaf. Figs 1-2.

Distribution (Figs 7, 8)

A. prostratum var. *prostratum* occurs along the southern coastline of Australia, extending as far North as Brisbane. It is also found to occur inland, unlike var. *filiforme* which tends to be more restricted to coastal situations. The variety also occurs in New Zealand.

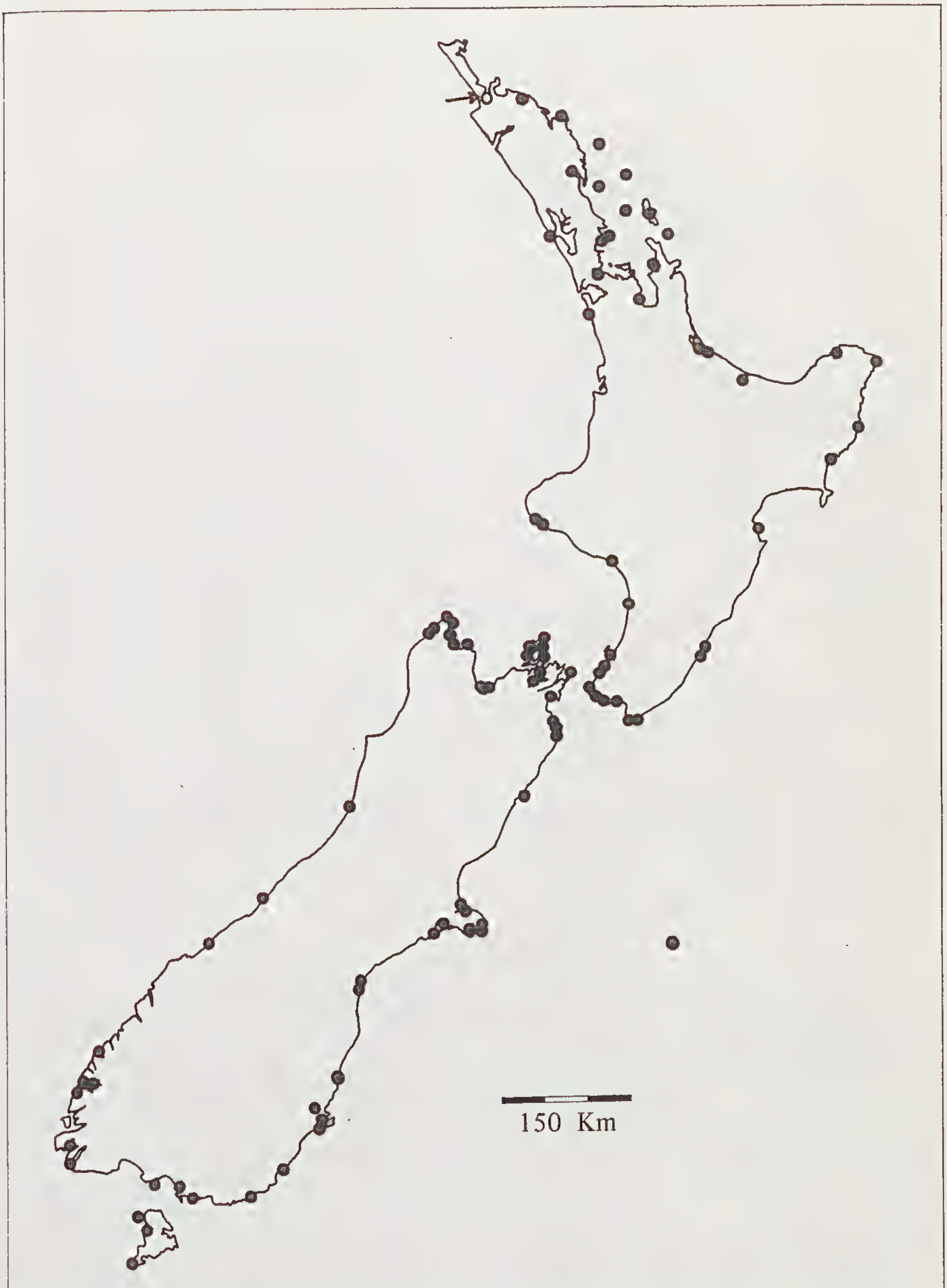

Fig. 8. Distribution of *A. prostratum* Labill. ex Vent. ssp. *prostratum* var. *prostratum* (circle), *A. prostratum* ssp. *prostratum* var. *filiforme* (A. Rich.) Kirk (dots) in New Zealand.

Ecology

The variety, when found on the coastline grows at the mouth of fresh-water rivers or drains or in brackish water in semi-saline swamps. Similarly when found in inland situations var. *prostratum* occurs in areas where fresh to brackish water is readily available.

Specimens examined: selection only, including important specimens cited by past workers, e.g. W.J. and J.D. Hooker.

WESTERN AUSTRALIA: *Aplin 1364*, two miles north of Bridgetown, 11.xii.1961 (PERTH); *Burbidge 8117*, Two Peoples Bay, E. of Albany, 24.i.1973 (PERTH); *Drummond 124*, s.dat. (K); *Drummond 141*, Swan River, s.dat. (K); *Olfield s.n.*, Murchison River, s.dat. (K).

SOUTH AUSTRALIA: *Alcock 3257*, Southern Eyre Pen., Hundred of Lincoln, i.iv.1970 (AD); *Cleland s.n.*, Encounter Bay, Inman River mouth, 16.i.1944 (AD 96011076); *Dodson 150*, Piccaninnie Ponds, 9.iii.1972 (AD); *Short 189-201*, Kingston, 7.iii.1976 (AD); *Wade s.n.*, Goolwa, 24.iii.1940 (AD 966050516).

VICTORIA: *Adamson 195*, Melbourne, 8.xi.1853 (K); *Morrison s.n.*, Plenty River, 16.i.1892 (CANB 129300); *Morrison s.n.*, Upper Werribee River, 9.xii.1893 (CANB 129301, K); *Morrison s.n.*, North Williamstown, 16.ii.1895 (AD 9641220, CANB 129303, K); *Short 178-185*, Glenelg River, Nelson, 5.iii.1976 (AD).

TASMANIA: *Backhouse s.n.*, Port Arthur, s.dat. (K); *Gunn 68*, Anderson's Creek, Yorketown, 11.i.1843 (NSW 139056); *Gunn 68*, Launceston, 24.xii.1844 (K); *Maiden s.n.*, Risdon Cove, -.ii.1906 (NSW 139077); *Maiden & Cambage s.n.*, Swanport to Swansea, -.i.1902 (NSW 139053).

NEW SOUTH WALES: *Coveny 107*, Manly Lagoon, 18.ii.1968 (NSW); *Cross & Vickery s.n.*, Narrabeen, 2.iii.1944 (NSW 139092); *Maiden s.n.*, Sussex Inlet, -.ii.1917 (NSW 139113); *Rodway s.n.*, Cronulla, 6.viii.1933 (NSW 90331); *Salasoo 3332*, S.W. shore of Wallis Lake, S.W. of Forster, 7.i.1967 (NSW)

QUEENSLAND: *Durrington & Batianoff 1451*, Heath Island 3.2 km W. of Cape Moreton, 18.xii.1974 (BRI, K); *MacGillivray B136*, Port Curtis, -.xi.1847 (K); *White 7192*, Noosa River, 17.i.1931 (BRI); *White 8821*, Currumbin, 12.xi.1932 (BRI).

NEW ZEALAND: *Carse s.n.*, Wharekia, Ranganui, -.i.1915 (CHR 3383); *Mathews & Carse s.n.*, Awanui River, s.dat. (CHR 18963); *Matthews & Carse s.n.*, Ohiro, Awanui Harbour, -.i.1914 (CHR 20553).

a.2. var. **filiforme** (A. Rich.) Kirk, Stud. Fl. N.Zeal. (1899)196; Cheesem., Man. New Zeal. Fl. 1 ed. (1906)205; Domin. Bibl. Bot. 89(1929)1048, ? p.p. — *Petroselinum filiforme* A. Rich., Fl. Nouv.Zel. Voy. Austrolabe Bot. (1832)278. — *Apium filiforme* (A. Rich.) Hook., Ic. Pl. 9(1851) t.819, (incl. var. α & var. β *trifidum;* q.v.); Hook. f., Fl. N.Zel. (1853)87; Hook. f., Handb. N.Zeal. Fl. 1(1867)90; Cheesem., Man. New Zeal. Fl. 2 ed. (1925)657; Wolff in Engler & Prantl, Pflanzenr. 90(1927)33; Allan, Fl. N.Zeal. 1(1961)462.

Type: "Crescit in humidis Novae-Zeelandiae, locis dictis detroit de look, havre de l'Astrolabe" P (photograph only seen).

Apium prostratum Labill. ex Vent.; Labill., Nov. Holl. Pl. Spec. 1(1805)76, t.103; F. Muell., First Syst. Cens. Austral. Pl. (1882)63, p.p. (excl. *A. insulare* Short, *A. annuum* Short, *A. prostratum* var. *prostratum* as to MEL collns); F. Muell., Key Syst. Vict. Pl. 2(1885)26, p.p. (as in preceding); F. Muell., Key Syst. Vict. Pl. 1(1887/8)269, p.p. (as in preceding); F. Muell., Sel. Extratr. Pl. (1888)40, p.p. (as in preceding); F. Muell., Sec. Syst. Census Austral. Pl. (1889)108, p.p. (as in preceding); C. Moore, Handb. Fl. N.S.W. (1893)221, p.p.; Hemsl., Ann. Bot. 10(1896)238, ? p.p.; Maiden, Proc. Linn. Soc. N.S.W. 23(1898)129, ? p.p.; Kirk, Stud. Fl. N.Zeal. (1899)196, p.p.; Maiden & Betche, Census N.S.W. Pl. (1916)162, p.p.; W.M. Curtis, Stud. Fl. Tasm. (1963)255, p.p. (excl. *A. insulare* Short and *A. prostratum* var. prostratum); Eichler, Suppl. to Black's Fl. S.Austral. (1965)252, p.p. (excl. *A. annuum* Short and *A. prostratum* var. *prostratum*); Beadle et al., Fl. Sydney Region (1972)396, p.p. (excl. *A. prostratum* var. *prostratum*); Willis, Handb. Pl. Vict. 2(1973)490, p.p. (excl. *A. insulare* Short, *A. annuum* Short and *A. prostratum* var. *prostratum* as to specs in MEL). — *Petroselinum prostratum* (Labill. ex Vent.(DC., Prod. 4(1830)102, p.p.; A. Rich., Fl. Nouv.Zel. (1832)278, p.p. (as to Labill. citation).

Apium filiforme var. β *trifidum* Hook., Ic.Pl.9(1851) t.819

Type: "Near Nelson, New Zealand, Mr Bidwill (n. 94A)" K.

? *Apium prostratum* var. *maritimum* Domin, Bibl.Bot.89(1929)1048

Type: Not known, see note 2.

Apium australe var. *latisectum* Wolff. nom.illeg. in Engler & Prantl, Pflanzenr.90(1927)32, p.p. (excl. *A. prostratum* var. *prostratum* as to *Drummond 124*, ? *A. insulare* Short as to *Gunn 386* (p.p.), ? *A. annuum* Short as to Mueller collections from South Australia and Victoria); Allan, Fl.N.Zeal.1(1961)463. Wolff's name is illegitimate as both the distribution and circumscription of the taxon given by Wolff includes the type of *A. australe* Petit-Thouars collected from Tristan da Cunha.

Apium australe auct.non (Pet.-Thou.: Benth., Fl. Austral. 3(1867)372, p.p. (excl. *A. annuum* Short, *A. insulare* Short, *A. prostratum* var. *prostratum*, *A. prostratum* ssp. *howense* Short): F.M. Bail., Syn. Queensl. Fl. (1883)212, p.p.: F.M. Bail., Queensl. Fl. (1900)724, p.p.; Rodway, Tasm. Fl. (1903)66, p.p. (excl. *A. insulare* Short and *A. prostratum* ssp. *prostratum* var. *prostratum*); F.M. Bail., Weeds and Pois. Pl. Queensl. (1906)64, p.p.; F.M. Bail., Compreh. Catal. Queensl. Pl. (1913)229, p.p.; Black, Fl. S.Austral. 1 ed. (1926)444, 2 ed. (1952)662, p.p. (excl. *A. annuum* Short, *A. prostratum* ssp. *prostratum* var. *prostratum* as to Anon, AD 97619035); Ewart, Fl. Vict. (1931)906, p.p.; W.R. Sykes, Kermadec Islands Fl. (1977)146.

Apium australe var. α Hook.f., F.N.Zel.1(1852)86; Hook.f., Fl.Tasm.1(1856)160; Hook.f., Handb.N.Zeal.Fl.1(1867).

Apium prostratum var. α T.F. Cheesem., Man.N.Zeal.Fl.(1906)205, p.p. (excl. Antarctic America, South Africa and Tristan da Cunha); Cheesem., Man.N.Zeal.Fl. 2 ed.(1925)657, p.p. (as in preceding).

Leaves opposite compound umbels with leaflets divided, elliptic, ovate, obovate, or ± cuneate, primary segments elliptic, ovate, obovate, or ± cuneate in outline, with length (ca. 0.5)2-3 times the greatest breadth, ultimate segments to tertiary order (8)12-40(74) per leaf. Figs 1-2.

Distribution (Figs 7, 8)

A prostratum var. *filiforme*, like the preceding variety, is distributed along the southern coastline and along the eastern coastline of Australia as far north as Brisbane. It also occurs in New Zealand.

Ecology

A. prostratum var. *filiforme* is almost invariably restricted to the coastline growing away from river mouths in often quite exposed areas of the foreshore.

Notes

1. The name var. *filiforme* was originally applied by Richard (1899) when describing the thin stems of the plant. It does not refer to leaf shape which is anything but filiform.

2. It is unclear whether Domin considered specimens from Brisbane River (*Dietrich 364*, *White s.n.*) to belong to *A. prostratum* var. *maritimum* as he cited these collections immediately below his notes on the geographical distribution of the species and above the description of the variety. Neither of the specimens have been labelled *A. prostratum* var. *maritimum* and neither appears to fit within the circumscription of the variety. Domin (1929, p. 1048) described this variety as having "foliis pinnatis, segmentis brevioribus latis, plerumque obovatis vel obcuneatis, caulibus robustis". The branches of *Dietrich 364* (Fig. 9) are robust but in both this and the *White s.n.* collection the leaf segments are not shorter than their width. This applies irrespective of the definition of a segment. All leaflets and segments, as defined in the present paper, are usually longer than, or approximately equal to, their width. Both specimens are best regarded as intermediates between var. *prostratum* and var. *filiforme* (A. Rich.) Kirk of *A. prostratum* ssp. *prostratum*.

Fig. 9. *A. prostratum* Labill. ex Vent. ssp. *prostratum* var. *prostratum-filiforme* (*Dietrich 364*. PR).

Fig. 10. *A. prostratum* Labill. ex Vent. ssp. *howense* Short Holotype (*Chinnock s.n.* AD 97803258).

Specimens examined: selection only, including important specimens cited by past workers, e.g. J.D. Hooker, H. Wolff.

WESTERN AUSTRALIA; *Colli(s) s.n.*, Cape Naturaliste, s.dat. (K); *Demarz 4253*, road to natural bridge, Albany, 9.i.1973 (PERTH); *Drummond 293*, Swan River, s.dat. (K); *Newbey 3135*, 2 miles S. of Middle Mt. Barren, 21.iii.1970 (PERTH); *Royce 5424*, West Cape Howe, 7.iii.1956 (PERTH).

SOUTH AUSTRALIA; *Lothian 822*, Flour Cask Bay, Kangaroo Island, 12.i.1962 (AD); *Short 50-104*, Pt Elliot, 17.ii.1976 (AD); *Short 108-126*, Robe sand dunes, 5.iii.1976 (AD); *Short 130-134*, Cape Lannes, 5.iii.1976 (AD); *Wilson 1159* near Beachport, 12.xi.1959 (AD).

VICTORIA: *Johnson s.n.*, Mt Martha, -.ii.1949 (NSW 139067); *Morrison s.n.*, Cheltenham, 14.i.1893 (K); *Morrison s.n.*, Brighton, 24.iv.1895 (BRI 214147); *Weston 1640*, Nelson, south of mud lake near beach, 30.ix.1965 (AD); *Williamson s.n.*, Port Fairy, -.xi.1902 (NSW 139063).

TASMANIA: *Garden s.n.*, Ocean Beach, Strahan, 20.i.1949 (NSW 139054); *Gunn 386*, Circular Head, 7.i.1837 (K); *Gunn 386*, 5 Mile Bluff, 27.i.1843 (NSW 139055); *Belcher & Belcher 1481*, South Cape Bay, 15.ii.1968 (AD); *Whinray 716*, Big Chalky Island, Furneaux Group, s.dat. (AD).

NEW SOUTH WALES: *Atkin s.n.*, Kiama, 12.i.1905 (NSW 13963); *Blaxell 205*, Big Gibber, east of Bombah Pt, Myall Lakes, 13.ii.1969 (NSW); *Constable s.n.*, Red Head Beach, 10 miles N.E. of Milton, 26.x.1957 (NSW 43113); *Helms s.n.*, Botany Bay, 1.xi.1901 (NSW 139089); *Maiden s.n.*, Wreck Bay, -.iii.1917 (NSW 139098).

QUEENSLAND: *Black 13819*, Stradbroke Is., 24.vii.1938 (BRI).

NEW ZEALAND: *Allan s.n.*, Chalky Inlet, Fiordland, 30.i.1946 (CHR 93152-93154); *Colenso 89*, N. Zealand, -.-.1847 (K); *Colenso 230*, N. Zealand, -.-.1847 (K); *Colenso 2047*, N. Zealand, s.dat. (K); *Sneddon s.n.*, Uawa R. estuary Tolaga Bay, East Cape, 9.xii.1967 (WELTU 7149).

b. ssp. **howense** Short, subspecies nova

?*Apium prostratum* Labill, ex Vent.: F. Muell., Fragm.Phyt.Austral.6(1871)148; Hemsl., Ann.Bot.10(1896)238; Maiden, Proc.Linn.Soc.N.S.W.23(1898)129; W. Oliver, Trans.-N.Z.Inst.49(1917)146.

Apium australe auct.non Pet-Thou.: Benth., Fl. Austral. 3(1867)372, p.p. (as to Macgillivray colln., Lord Howe Is.).

Folia umbellas compositas opposita (3.5)4-5(5.7) cm longa, foliola semper primaria, 5-7, divisa, segmentis primariis trifidis tripartitisve (1.0)1.1-2.5(3.6) mm latis proxime infra divisiones segmenta secundaria facientes, segmentis ultimis usque ad ordinem tertium, 37-66 per folium; *folia basalia* ut videtur simillima.

Holotypus (Fig. 10): *Chinnock s.n.*, Lord Howe Island, coastal cliff near jetty, growing on bare limestone, 27.xi.1968 (AD 97803258, ex WELTU 8113).

Isotypus: WELTU 8113.

Leaves opposite compound umbels (3.5)4-5(5.7) cm long; leaflets primary only, ca. 5-7, divided, with primary segments trifid to tripartite, (1.0)1.1-2.5(3.6) mm broad immediately below divisions forming secondary segments, ultimate segments up to tertiary order, 37-66 per leaf; *basal leaves* apparently identical to leaves opposite umbels. Fig. 10.

Distribution

The subspecies appears to be restricted to Lord Howe Island.

Ecology

Only coastal collections have been made of this subspecies.

Notes

1. The restricted distribution as well as the distinctive leaf have formed the basis for the recognition of this taxon as a subspecies of *A. prostratum.*

Specimens examined: all specimens, excluding types.

LORD HOWE ISLAND: *Green 1921*, Signal Point, on coral rocks just above splash zone, *Hoogland 8635*, Middle Beach area, 27.x.1963 (CANB); *Lind & Fullager s.n.*, Lord Howe Island, s.dat. (MEL); *McComish 40*, small herb growing a few feet above H.W. mark, -.x.1936 (K); *MacGillivray 714*, Lord Howe Island, banks by the seashore, .ix.1853, (K); *Mo(ire) s.n.*, Lord Howe Island, s.dat. (K).

c. ssp. **denticulatum** Short, subspecies nova

? *A. australe* auct.non Pet.-Thou.: Allan, Fl. N.Zeal. 1(1961)463, p.p. (possibly as to some Chatham Is. occurrences).

Folia umbellas opposita ca. 6 cm long; foliola semper primaria, 3-5, divisa, segmentis primariis denticulatis, segmentis ultimis usque ad ordinem tertium, ca. 50-80(120); *folia basalia* foliis umbellas oppositibus simillima, ca. 3-5(7) foliolatis.

Holotypus (Fig. 11): *Moar 1552,* Te Whanga Lagoon, Chatham Is., limestone rocks, 5.xi.1959 (CHR).

Leaves opposite umbels ca. 6 cm long; leaflers primary only, 3-5, divided, with primary segments with denticulate margins due to the large number of secondary and/or tertiary segments, ultimate segments up to tertiary order, ca. 50-80(120); *basal leaves* similar to leaves opposite umbels with ca. 3-5(7) leaflets. Fig. 11.

Distribution

This taxon appears to be restricted to Chatham Island.

Ecology

Moar's (*1552*) collection was recorded as growing in limestone rocks while Burke's collection (*WELTU 4003*) was found growing in sand on the shore of a lagoon.

Specimens examined: all specimens, excluding holotype.

CHATHAM ISLANDS: *Anon.,* Point Weeding, Chatham Is., 15.ii.1967 (CHR 176561); ? *Bell s.n.,* South East Island, Chatham Islands, .xii.1961 (CHR 159015); *Burke s.n.,* growing in sand on shore of lagoon, Chatham island, 1.iv.1967 (*WELTU 4003*); *Talbot s.n.,* Chatham island, -.ii.1968 (CHR 268957, 268958).

d. ssp. **"A"**, ssp. not named

Leaves opposite umbels to 14.5 cm long; leaflets primary and secondary, ca. 9 in all, divided, with primary segments pinnatifid, narrow, ultimate segments up to quaternary order, greater than ca. 100-150 per leaf; *basal leaves* not seen. Fig. 12.

Distribution

This unnamed taxon has only been collected from the Porongorup Ranges, Western Australia.

Ecology

No information available.

Notes

1. This taxon may not belong to *A. prostratum.* For correct identification of *Apium* species it is desirable to view mature mericarps, but unfortunately the collection of this taxon entirely lacks fruit. However, inflorescence and floral characters that can be observed suggest that the affinities are with *A. prostratum.*

Specimens examined

WESTERN AUSTRALIA: *Anon. s.n.,* Porongorups, -.x.1867 (MEL 503681, MEL 503682, MEL 503694).

2. **Apium insulare** Short, species nova

Apium prostratum auct.-non Labill. ex Vent.: W.M. Curtis, Stud. Fl. Tasm. (1963)255, p.p.; Willis. Handb. Pl. Vict. 2(1973)490, p.p. *Apium australe* auct.-non Pet.-Thou.: Benth., Fl. Austral. 3(1867)374, p.p. (excl. *A. annuum* Short, e.g. *Anon.* MEL. 503676. *A. prostratum* Labill. ex Vent. as to MEL. collns.); F.M. Bail., Queensl. Fl. 2(1900)724, p.p.

Herba terrestris, biennis perennisve, glabra, erecta, caule ca. 50-70 cm alto, crasso, 0.8-1 cm diametro. *Folia umbellas compositas opposita* (4.4)6-12(16.7) cm longa; foliola primaria et saepe secundaria, omnino (3)5-7(9), crassa, late obovata in ambitu, divisa segmentis primaris usque quaternariis, segmentis ultimis acutis obtusisve, (22)50-250(300) per folium; *folia basalia* non vidi. *Umbellae compositae* semper pedunculatae; pedunculus (0.2)2-5(8.7) cm longus, (1)2-3(4) mm diametro; bracteae plerumque nullae, interdum una praesens; bracteolae semper

Fig. 11. *A prostratum* Labill. ex Vent. ssp. *denticulatum* Short Holotype (*Moar 1552*, CHR).

Fig. 12. *A. prostratum* Labill. ex Vent. ssp. 'A'. (*Anon.* MEL 503694).

nullae; radii (8)10-18(20) per pedunculum, (0.65)2-3(4.6) cm longi, 0.3-1 mm diametro; pedicelli ca. 15-25 per radium, (2)2.5-4(6.5) mm longi. *Petala* alba nervo medio luteo-brunneo, ovata, (0.75)0.85-1.0(1.1) mm longa, (0.6)0.8-0.9(1.0) mm lata, ad basem constricta, apice acuto. *Stamina* petala aequantia excedentiave, (0.9)1.0-1.1(1.2) mm longa; filamenta alba ± luteave; antherae albae ± luteave, 0.4 mm longae lataeque. *Ovarium* glabrum, stylopodio disciformi, stylo (0.6)0.7-0.8 mm longo, stylopodio ca. duplo longiore. *Schizocarpium* ovato-orbiculare orbiculareve, 1.5-2.7 mm longum, 1.2-2.5 mm latum; carpophorum brevissime bifidum; mericarpia in sectione radiali-longitudinali in pagine commissurali plana, costis prominentibus suberosis fere tecta, pariete seminis inter costos vix distinguibili. *Chromosomatum numerus* ignotus.

Holotypus (Fig. 13): *Mattingley s.n.*, Hogan Group, Bass St., 28.xi.1937 (MEL 503672).

Terrestrial, biennial or perennial *herb*, glabrous, erect, with stem ca. 50-70 cm tall, thick, 0.8-1 cm diameter. *Leaves opposite compound umbels* (4.4)6-12(16.7) cm long; leaflets primary and often secondary, (3)5-7(9) in all, thick, broadly obovate in outline, divided with primary up to quaternary segments, ultimate segments acute to obtuse, (22)50-250(300) per leaf; *basal leaves* not seen. *Compound umbels* consistently pedunculate; peduncle (0.2)2-5(8.7) cm long, (1)2-3(4) mm diameter; *bracts* generally absent, occasionally one present; bracteoles always absent; rays (8)10-18(20) per peduncle, (0.65)2-3(4.6) cm long, 0.3-1 mm diameter; pedicels ca. 15-25 per ray, (2)2.5-4(6.5) mm long. *Petals* white with yellow-brown mid vein, ovate, (0.75)0.85-1.0(1.1) mm long, (0.6)0.8-0.9(1.0) mm wide, constricted at base, apex acute. *Stamens* equal to or greater than the length of the petals, (0.9)1.0-1.1(1.2) mm long; filaments white to ± yellow; anthers white to ± yellow, 0.4 mm long, 0.4 mm wide; *ovary* glabrous; stylopodium disc-like; style (0.6)0.7-0.8 mm long, about twice the length of the stylopodium. *Schizocarp* ovate-orbicular to orbicular, 1.5-2.7 mm long, 1.2-2.5 mm broad; carpophore very shortly bifid; mericarps in radial longitudinal section flat on commissural surface, almost covered by prominent corky ribs, with seed wall barely apparent between ribs, transverse section not made (material inadequate). *Chromosome number* unknown. Fig. 13.

Distribution (Fig. 7)

A. insulare has only been collected from Lord Howe Island and islands in Bass Strait.

Notes

1. It is desirable to see more collections of *A. insulare* as at present the full range of variation exhibited by characters is unknown.

2. *A. insulare* exhibits the erect, robust stem of *A. australe* (Fig. 6) but the latter taxon can be readily distinguished from *A. insulare* by the presence of the more or less lanceolate leaflets and segments of the leaves surrounding the umbels.

Specimens examined: all specimens, excluding holotype.

VICTORIA: *Brown s.n.*, Bass St., s.dat. (MEL 503673).

LORD HOWE ISLAND: *Fullager & Lind 81*, Lord Howe Island, s.dat. (MEL); ? *Fullager & Lind s.n.*, Lord Howe Island, s.dat. (MEL 503678); *Green 1962*, Salmon Beach, 2.ix.1971 (K).

3. **Apium annuum** Short, species nova

Apium prostratum auct. non Labill, ex Vent.: F. Muell., First Syst. Census Austral. Pl. 2(1882)63, p.p.; F. Muell., Key Syst. Vict. Pl. 2(1885)26, p.p. F. Muell., Key Syst. Vict. Pl. 1(1887/8)269, p.p.; F. Muell., Sec. Syst. Census Austral. Pl. (1889)108, p.p.; Eichler, Suppl. to Black's Fl. S.Austral. (1965)252, p.p.; Willis, Handb. Pl. Vict. 2(1973)490, p.p.

Apium australe auct. non Pet.-Thou.: Benth., Fl. Austral. 3(1867)372, p.p.; F.M. Bail., Queensl. Fl. (1900)724, p.p. ?; Black, Fl. S.Austral. 1 ed. (1926)444, 2 ed. (1952)662, p.p.; Ewart, Fl. Vict. (1930)906, ? p.p.

Herba terrestris, annua, glabra, caule minuto vel erecto ramificantique, (.13)3-10(18.5) cm alta. *Folia umbellas compositas opposita* late obovata usque late ovata in ambitu, (0.5)2-4(10) cm longa; foliola semper primaria, (1)3-5(7), late elliptica usque late obovata, segmentis semper primariis, plerumque secundariis, interdum tertiis, raro quaternariis, segmentis ultimis ovatis acutisve, (3)7-30(60) per folium; *folia basalia* foliis in caulibus plantae erectae

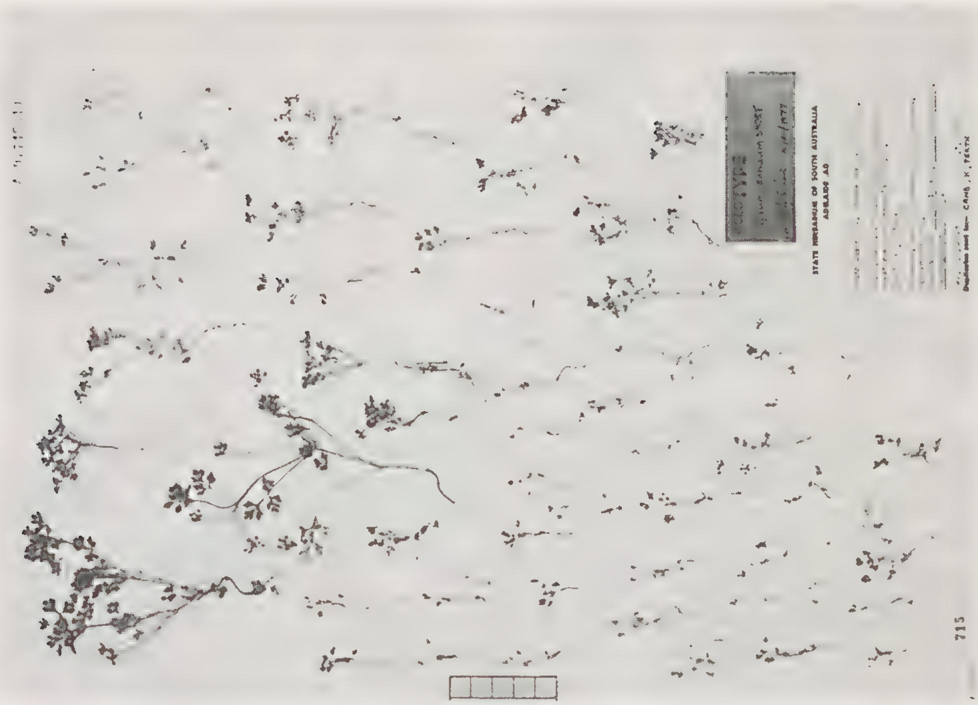

Fig. 14. *A. annuum* Short Holotype (*Short 715*, AD).

Fig. 13. *A. insulare* Short Holotype (*Mattingley s.n.*, MEL 503672).

similaria sed aliquantum minus divisa. *Umbellae compositae* plerumque sessiles, raro pedunculatae; pedunculus abi praesens (1.1)1.5-4(6.5) cm longus; bracteae bracteolaeque semper nullae; radii (1)2-4(5) per inflorescentiam, (0.67)1-4(7.8) cm longi; pedicelli (2)4-10(15) per radium, 0.1-4.5(5.2) mm longi. *Petala* alba nervo medio luteo-brunneo, ovata, 0.6-0.75 mm longa, (0.35)0.4-0.5 mm lata, ad basem constricta, apice acuto. *Stamina* longitudine ¾ petalorum partes aequantia, (0.35)0.4-0.5(0.6) mm longa; filamenta alba ± luteave; antherae albae, ± luteae purpureaeve, 0.15-0.2 mm longae, 0.15-0.25 mm latae. *Ovarium* glabrum, stylopodio disciformi, stylo 0.15-0.25 mm longo, altitudine stylopodium circa aequanti. *Schizocarpium* ovato-orbiculare usque orbiculare, 1.1-2.7 mm longum, 1.1-3 mm latum; carpophorum brevissime bifidum; mericarpia in sectione radiali-longitudinali in pagine commissurali concava, in sectione transversali hexagona, costis prominentibus, latitudine spatia ad parietem seminis circa aequantibus, vittis magnis, in saptiis solitariis, in commissura duobus. *Chromosomatum numerus:* n = 11.

Holotypus (Fig. 14): *Short 715,* Yorke Peninsula, ca. 8.5 km S. of Corny Point Lighthouse on coast road to Gleeson's Landing, (34° 58′ S, 136° 58′ E), 9.x.1977 (AD, fl., immature fr.).

Isotypi: AD, CANB, K, PERTH (fl., immature fr.).

Topotypi: Short 205, 13.iii.1965 (AD); *Short 206,* 13.iii.1976 (AD, CANB, K, PERTH, mature fr.).

Terrestrial, annual *herb;* glabrous, stem minute or erect and branching, (1.3)3-10(18.5) cm tall. *Leaves opposite umbels* broadly obovate to broadly ovate in outline, (0.5)2-4(10) cm long; leaflets always primary, (1)3-5(7), broadly elliptic or obovate, with always primary, usually secondary, sometimes tertiary, rarely quaternary segments, ultimate segments ovate or acute, (3)7-30(60) per leaf; *basal leaves* similar to leaves on stem of erect forms but usually somewhat less divided. *Compound umbels* usually sessile, rarely pedunculate; peduncle when present (1.1)1.5-4(6.5) cm long; bracts and bracteoles always absent; rays (1)2-4(5) per inflorescence, (0.67)1-4(7.8) cm long; pedicels (2)4-10(15) per ray, 0.1-4.5(5.2) mm long. *Petals* white with yellow-brown midvein, ovate, 0.6-0.75 mm long, (0.35)0.4-0.5 mm wide, constricted at base, apex acute. *Stamens* approximately ¾ length of the petsls, (0.35)0.4-0.5(0.6) mm long; filaments white or ± yellow; anthers white, ± yellow or purple, 0.15)0.2 mm long, 0.15-0.25 mm wide. *Ovary* glabrous; stylopodium disc-like; style 0.15-0.25 mm long, about equalling height of stylopodium. *Schizocarp* ovate-orbicular to orbicular, 1.1-2.7 mm long, 1.1-3 mm broad (lower measurements probably pertain to immature fruit); carpophore very shortly bifid; mericarps in radial longitudinal section concave on commissural surface, hexagonal in transection, ribs prominent, with the width of the intervals at the seed face approximately equal to the width of the ribs, vittae large, solitary in the intervals, 2 on the commissure. *Chromosome number:* n = 11. Figs: 3-5, 14.

Distribution (Fig. 7)

The species is common in inland and coastal situations in Western Australia, South Australia and Victoria.

Ecology

A. annuum occupies a wide range of habitats, being found in coastal foreshore situations and inland situations where it may be found in *Eucalyptus camaldulensis* and *Casuarina* communities or with *Arthrocnemum* around the margin of salty depressions.

It flowers in late spring and early summer.

Notes

1. Using Wolff's (1927) key to the sections of *Apium, A. annuum* would be placed in his section *Ciclospermum* (Lag.) Wolff or, as followed here, the genus *Ciclospermum* Lag. This is a result of the sectional divisions in Wolff's key being based on, among other things, the life-span of the species. Under this scheme all annuals are placed in *Ciclospermum.* However, *A. annuum* differs from the members of *Ciclospermum* in many diagnostic characters and clearly belongs to *Apium* sect. *Apium.* Table 2 summarizes the characteristics of the genus *Ciclospermum, Apium* sect. *Apium* and *A. annuum.*

Table 2: The characteristics of *Apium* sect. *Apium*, *A. annuum* Short and *Ciclospermum* Lag.

	Sect. Apium	A. annuum	Genus Ciclospermum
Life-span	biennial or perennial	annual	annual
Cotyledons	round type	round type	long type
Pollen	oval	oval?	sub-rhomboidal
Fruit	glabrous	glabrous	glabrous or setulose
Chromosomes	n = 11	n = 11	n = 7

The pollen and cotyledon characters included in the table have been given much weight by Cerceau-Larrival (1964, 1971) in the recognition of tribes in the Apioideae. She regards the genus *Ciclospermum* to be far removed from the genus *Apium*.

2. *Ciclospermum leptophyllum* (Pers.) Sprague can be easily distinguished from *Apium annuum*, and indeed all Australasian species of *Apium*, on vegetative characters alone. This species is an erect annual about 40-60 cm high and possesses leaves which are divided into many filiform segments.

3. The collection *Eichler 17781* (15.xii.1963 ca. 12 km north of Kingston, South East, South Australia AD) appears to contain mature plants nearly all of which have lost their leaves. The plants are little more than 5 cm tall and many have pedunculate compound umbels. The apparently mature mericarps appear to differ from those of *A. annuum* in having small acute ribs (Fig. 5).

Specimens examined: selection only.

WESTERN AUSTRALIA: *Royce 8792*, East of Esperance, 22.x.1969 (PERTH); *Royce 9956*, Cape Arid National Park, 1.xii.1971 (PERTH); *Short 673*, salty depression 1 km E. of Wave Rock, Hyden, 25.ix.1977 (AD); *Willis s.n.*, Figure-of Eight Island, Recherche Archipelago, 7.xi.1950 (MEL 503670); *Wilson s.n.*, Fitzgerald R. Reserve ca. 6 km W. of Middle Mt Barren, 6.x.1970 (PERTH).

SOUTH AUSTRALIA: *Ising s.n.*, Granite Island, 6.x.1968 (AD 96804027); *Orchard 2276*, Gawler Ranges, Yandinga Gorge, 26.ix.1969 (AD); *Wace 223*, Dog Island, Isles of St. Francis, Nuyts Archipelago, 3.x.1972 (AD); *Weber 4367*, Pondalowie Bay, 13.x.1974 (AD); *Wheeler 1404*, Remarkable Rocks at Kirkpatrick Point, Kangaroo Island (AD).

VICTORIA: *Mueller s.n.*, Hopkins River, s.dat. (D); *Walter s.n.*, Wimmera District, -.x.1900 (NSW 139060).

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Index to Scientific Names

Names

New names are in bold type. Synonyms and misapplied names are in italics.

Page Numbers

Page numbers in bold type refer to the main taxonomic treatment. Page numbers asterisked refer to figures and maps.

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TEN NEW SPECIES OF *EREMOPHILA* (MYOPORACEAE) FROM CENTRAL AND WESTERN AUSTRALIA

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Abstract

Ten new species of *Eremophila* are described from Central and Western Australia, namely *E. alatisepala* (S.W. Qld), *E. arachnoides* (SA, WA), *E. bicolor* (WA), *E. biserrata* (WA), *E. gibbosa* (WA), *E. glutinosa* (WA), *E. ovata* (NT), *E. purpurascens* (WA), *E. serpens* (WA), and *E. verrucosa* (SA). Two subspecies are distinguished in both *E. arachnoides* and *E. verrucosa*. Each species is illustrated, and distribution maps, ecological, cytological and horticultural data are provided where available.

Introduction

When Kraenzlin published his monograph of the Myoporaceae in 1929 he recognized the three genera *Eremophila, Pholidia* and *Stenochilus* described by Robert Brown in 1810. Until 1859 Ferdinand Mueller, who had made a particular study of the Australian Myoporaceae and had published the majority of species then known, also recognized these three genera. However, as new species came to hand he found it more difficult to recognize them, and eventually in 1859 he reduced *Pholidia* and *Stenochilus* to synonymy in *Eremophila.*

Kraenzlin's treatment of the genera *Eremophila, Pholidia* and *Stenochilus* was quite inadequate and Mueller's later view is still followed in Australia. Kraenzlin's sections are quite artificial and in many instances illegitimate because he ignored previous work on the genera. The main value of the monograph was that it was the first comprehensive treatment of the family since that of Bentham (1870) bringing together the numerous species which had been published since 1870.

Subsequent to Kraenzlin's monograph an additional thirteen species have been added to *Eremophila* by Gardner (1934, 1942), White (1944), Smith (1956), Shaw (1967), Dell (1975) and Henderson (1978). A few of these species have resulted directly or indirectly from regional studies of *Eremophila* (Smith 1956, Henderson 1978), but the majority consisted of miscellaneous additions to the genus.

It will be a few years before I can complete the revision of the genus, which I have undertaken largely because of the many new species involved and several species complexes which will require considerable field work. However, at this point I consider it appropriate to publish a small number of these new taxa for two reasons: firstly, to update the knowledge of the species found in central Australia in preparation for the treatment of the genus in the proposed "Flora of Central Australia"; secondly, to provide names for a number of species now widespread in cultivation and which have horticultural merit.

Most sectional treatments of *Eremophila* are unsatisfactory. In the present paper only those species in sections *Stenochilus* (R.Br.) F. Muell. and *Pholidia* (R.Br.) F. Muell., which are considered to be clearly delimited, are placed in sections at this stage.

Descriptions, with few exceptions, have been based on both living and dried material and most illustrations were made from live material supplemented, where necessary, by preserved specimens. Herbarium abbreviations follow Holmgren and Keuken (1974) except for King's Park Herbarium, Perth, which is designated KP.

1. **Eremophila ovata** Chinnock sp. nov.

Ab *Eremophila strongylophylla* F. Muell. differt lamina folii ovata, petiolo longiore subtereti, indumento calycis, stylo hirsuto et fructu minore pilis tenuioribus brevioribusque. (Fig. 1)

Fig. 1. *Eremophila ovata* Chinnock (A-I) and *E. strongylophylla* F. Muell. (J-N). A, habit; B-F, M, N, leaf variation; G, J, inner and outer surfaces of calyx-segment, respectively; H, K, basal hairs on outer surface of calyx-segment. I, L, mature fruit showing size difference and length of indumentum. (A-C, G, H, I, *Latz 379; D. Chippendale 3591;* E, *Tate AD95709089;* F, *Beauglehole 20561;* J-L, *Ashby 3881;* M, N, *Chinnock 3756).*

Type: 30 miles (48 km) S of Areyonga, Northern Territory, *P.K. Latz 379*, 13.xii.1968, fl.fr. (holotype: NT; isotypes: AD, BRI).

The specific epithet refers to the leaf shape.

Rounded odorous *shrub* to 1 m tall and broad. *Branchlets* terete, densely pubescent; hairs of three types — short stellate, short glandular and numerous longer glandular hairs, 1-1.5 mm long; indumentum of young growth often brownish-yellow. *Leaves* alternate, distinctly petiolate; petiole subterete, (0.35-)0.5-0.7(-1.1) cm long, with indumentum as for lamina; lamina sparsely to densely stellate pubescent on the lower surface, slightly less densely hairy to glabrous on the upper, with scattered short glandular hairs on one or both surfaces, ovate or more rarely ovate-elliptic to almost orbicular; apex acute, more rarely obtuse, (0.8-)1.0-2.5(-3.5) cm long, (0.6-)0.9-1.4(-1.7) cm broad. *Flowers* solitary, sessile or subsessile; pedicel 0.2 mm long, densely stellate-pubescent. *Calyx* 5-partite, non-imbricate; segments almost equal, densely pubescent outside; the hairs stellate and glandular, with many longer glandular and eglandular sectaceous long hairs 1-1.5 mm, densely glandular hairy inside in the upper part, with sparsely to densely, simple or branched eglandular hairs and scattered short glandular hairs in the lower part, narrow linear-triangular to linear-lanceolate, 9-12 mm long. *Corolla* 2-2.5 cm long, lilac to scarlet, moderately sub-stellate pubescent outside except for the constricted lower part of the tube; inside of tube arachnoid hairy, the lobes glabrous or the lowermost lobe with a few hairs towards the base; narrow cylindrical in the lower tube for c. 6 mm abruptly dilating above; lobes 5, the upper lip consisting of two lobes, the lower of three, obtuse, the lowermost lobe dilated. *Stamens* included; filaments and anthers glabrous. *Ovary* oblong-ovoid, densely tomentose; the hairs stellate to branched; 2-3 mm long, 1.5 mm broad; style sparsely hirsute in the lower two-thirds. *Fruit* dry; indumentum as for ovary, ovoid 4.5-6.5 mm long, 4 mm broad. *Seed* white, oblong c. 2.5 mm long, c. 0.8 mm broad, 1 or 2 per fruit.

Distribution

Northern Territory — restricted to the George Gill and Gardiner Ranges (Map 1).

Specimens examined

Bagots Spring Creek, George Gill Range, *A.C. Beauglehole 20561*, 11.x.1966, fl.fr. (AD); Bagots Creek, George Gill Range, *A.C. Beauglehole 23525*, 9.vii.1967, fr. (NT); Bagots Creek, *A.C. Beauglehole 27101*, 16.vii.1968, fl. (NT); Bagots Creek, *G. Chippendale s.n.*, 13.viii.1957, fl. (AD, CANB, NT); Gardiner Range, 23° 55′ S, 131° 50′ E, *P.K. Latz 6656*, 8.xi.1976, fl. (NT); West of Areyonga, 23° 56′ S, 132° 00′ E, *P.K. Latz 6690*, 8.xi.1976, fl. (NT). East end of George Gill Range, *R. Tate s.n.*, 1894, fl. immature fr. (AD97448202); Bagots Creek Gorge, *R. Tate s.n.*, 1894, fl.fr. (AD95709089).

Affinities

Eremophila ovata and *E. strongylophylla* are very closely allied, and may have been derived from a widespread common ancestor. The two species are now widely separated geographically, and have diverged sufficiently in my opinion to be considered distinct. *E. ovata* is confined to the George Gill and Gardiner Ranges of Central Australia while *E. strongylophylla* occurs in the region of Shark Bay in the extreme west of Western Australia (see Map 1).

Many vegetative and floral features of the two species are similar and a considerable degree of overlap occurs. However, the two differ markedly in the leaf and fruit. The leaves of *E. ovata* are ovate with a well developed subterete petiole. The indumentum of the two leaf surfaces differs in density of the hairs and the upper surface is glabrous in many plants (including the type). The margins are flat. Leaves of *E. strongylophylla* are very widely obovate to orbicular with a very short broad petiole with well developed laminal expansions (Fig. 1. M, N). Indumentum is of similar density on both surfaces. The margins are slightly undulate. The fruit of *E. strongylophylla* is slightly larger than *E. ovata* and has a longer indumentum which is more or less floccose towards the apex. *Eremophila ovata* is also reported to be an odorous shrub unlike *E. strongylophylla*.

2. **Eremophila glutinosa** Chinnock sp. nov.

E. ramosissima Gardn. MS., Enum.Pl.Aust.Occ.3:120(1931); Gardn. ex Barlow, Aust.J.Bot.19:296(1971) *nomen nudum; Eremophila* sp., Grieve and Blackall, W.Aust.Wildfls.4:643(1975).

Ab *Eremophila granitica* S. Moore differt foliis densius aggregatis, pedicello vel sessili vel breve et segmentis calycis anguste lanceolatis longe acuminatis. (Fig. 2).

Type: Yagahong Hill, 30 km N of Yarabubba Homestead, Western Australia, 26° 54′ S, 118° 40′ E, *R.J. Chinnock 1021*, 14.ix.1973, fl. fr. (holotype: AD isotype: PERTH).

The specific epithet refers to the glutinous nature of the vegetative and floral parts.

Shrub 1-2 m tall with ascending or erect stems; *branchlets* terete, densely glandular hairy, extremely viscid in younger parts, the surface densely covered with sessile glands; the hairs and glands often obscured by the resin; bark light brown but covered with darker detritus and appearing dark grey flecked light brown; irregularly flaking and shallowly fissured; internodes 0.1-0.3 mm. *Leaves* alternate, sessile, erect or spreading, densely clustered, minutely hairy, the hairs often obscured by resin, densely covered with sessile glands but these also usually obscured by resin and only visible in older parts where the resin has dried, bright deep green, sessile, narrow linear, channelled above, often curved, obtus, (0.8-)0.8-2.0(-2.7) cm long (0.5-)0.6-1.0(-1.3) mm broad, viscid, often lustrous. *Flowers* solitary, axillary, shortly pedicellate; pedicel slightly compressed, densely glandular pubescent, (1.5-)2-4.8(-6.5) mm long. *Calyx* 5-partite, imbricate, segments unequal the inner two narrower; green or pubplish, sparsely to very densely glandular and eglandular pubescent outside; the eglandular hairs long, white, segmented, common on the margins and lower half of the segment; inner surface glandular pubescent, smooth or tuberculate, the tubercules obscure or prominently raised; veins becoming prominent at the fruiting stage; narrow lanceolate, long acuminate, (6.0-)6.8-9.5(-10.5) mm long, (1.2-)1.8-2.6(-2.8) mm borad at the base. *Corolla* variable in length 1-2.5 cm, pale to dark lilac, darker spotted in tube, sparsely glandular pubescent outside, inside of tube hairy, with a dense band of lanate hairs extending from the base of the lowermost lobe down the tube; narrow cylindrical at the base for 2-4 mm, abruptly expanding into a laterally compressed tube; throat narrowly transversely elliptic or closed; lobes 5, the upper two fused for most of their length, reflexed, acute; the lower three spreading, the lowermost + broadly shortly sagittate, often projected above the lateral lobes closing the throat; lateral lobes ovate-elliptic, acute. *Stamens* included, filaments and anthers glabrous. *Ovary* oblong-ovoid, more or less ribbed, densely pubescent with larger eglandular hairs interspersed with shorter glandular ones, c. 4 mm long, 1.5 mm broad; style hirsute except near the apex, apex hooked. *Fruit* drupaceous, indumentum as for ovary but less dense, ovoic, slightly compressed, distinctly (more rarely obscurely) 4-ribbed, 2 restricted to the upper half and with minor coalescing ribs in the upper part between the primary ribs; often obscured by exocarp, 4-6 mm long, 3-4.5 mm broad. Seed unknown.

Distribution

Western Australia. Widespread in the Eremean Province especially the Wiluna — Meekatharra region (Map 1).

Representative specimens

Meekatharra Airport, *A.M. Ashby 4222*, 7.viii.1971, fl. (AD); 5 miles S of Bulga Downs Homestead, *B.A. Barlow 1335*, 5.viii.1967, fl. (AD); 25 km N of Cue, *B.A. Barlow 1637*, 22.vi.1969, v. (AD); Ca. 16 km S of Meekatharra, *B.A. Barlow 1641*, 23.vi.1969, fl. (AD); 8 km W of Laverton, *B.A. Barlow 1738*, 20.vi.1970, fl. (AD); Diemal Find, *J.S. Beard 4764*, 17.vii.1967, fl. (PERTH); Between Glen Ayle and Earaheedy, 25° 25′ S, 121° 50′ E, *J.S. Beard 4792*, 20.vii.1967, b. (PERTH, KP); Yagahong Hill, 30 km N of Yarrabubba, 26° 54′ S, 118° 40′ E, *R.J. Chinnock 1021A*, 14.ix.1973, fl. fr. (AD); 54.7 km E of Meekatharra, *R.J. Chinnock 3966*, fr. (AD); 13 km S of Paynes Find, *H. Demarz 38*, 13.v.1968, fl. (PERTH, KP); 90 miles NE of Meekatharra, Doolgurra Station, *J. Elkington 332*, July-Aug. 1968, fl. (PERTH); 136 miles E of Wiluna on the Giles road, *A. Fairall 1930*, 25.vii.1966, fl. (PERTH); 72 km S of Meekatharra, *T. Loffler 27*, Aug. 1977, fl. (AD); near 6 mile creek, Yoothapina Station, *J. Morrisey 98*, June 1974, fl. (PERTH); 11 miles W of Meekatharra, *N.H. Speck 594*, 3.ix.1957, fl. (AD, CANB); 43 miles SE of Mileura Homestead, *N.H. Speck 699*, 7.ix.1957, fl. (CANB).

Fig. 2. *Eremophila glutinosa* Chinnock. A, habit; B, enlargement of stem showing the hairs and resin covered surface; C, upper portion of leaf, back and front view respectively; D, outer (left and centre) and inner right views of calyx-segments to show hair variation; E, corolla; F, mature fruit; G, gynoecium. (A-G, *Chinnock 1021*, except D, at left, *Speck 594*).

Chromosome Number: n = 18 (Barlow 1971)

Affinities

It is closely related to *E. granitica* differing in the more densely clustered leaves, short internodes, subsessile flowers and the small narrow lanceolate calyx-segments which do not enlarge in the fruiting stage.

Ecology

Eremophila glutinosa is a very widespread species particularly common in the Meekatharra and Wiluna regions. It grows abundantly on and around rocky granite and basic hills and outcrops and also on the heavy red clay loams in surrounding areas.

3.**Eremophila alatisepala** Chinnock sp. nov.

A speciebus *Eremophilae* aliis differt calyce et pedicello infra calycem valde alato. (Fig. 3).

Type: 5 km NW of Palparara, Gregory North District,Queensland 24° 46′ S, 141° 26′ E, *R.E. Isaacson 20,* 21.viii.1976 (holotype: AD; isotypes: BRI, CANB, K, NY).

The specific epithet is derived from the very prominent wings formed by the margins and bases of the calyx-segments and the upper pedicel which are diagnostic for this species.

Rounded shrub to 2 m tall and broad; branchlets, leaves, pedicel and calyx-segments glabrous, densely covered with sessile spherical glands, extremely viscid. *Branchlets* dark blackish-brown, leaf bases persistent, rough, internodes 2-3 mm. *Leaves* alternate, indistinctly petiolate, crowded, deep green, narrow linear-lanceolate, entire or slightly sinuate and sometimes the margins repand, attenuate towards the apex and base, (3.7-)4.0-5.7(-6.0) cm long. (1.2-)1.7-3.5(-5.0) mm broad. *Flowers* axillary, solitary, drooping pedicellate; pedicel about 1 cm long, winged in the distal part. *Calyx* 5-partite, segments unequal, attached at the basal centre, pale yellow to greenish-yellow, glabrous outside, glandular pubescent within, the 3 outer, ovate, acute, one distinctly larger; their margins flanged out to form three wings which extend down the receptacle and upper part of the pedicel, 1.5-2.0 cm long, 6-8 mm broad, enlarging slightly in fruiting stage; 2 inner segments glandular pubescent on both surfaces, narrow oblong-lanceolate 9-10 mm long, 2.5-3 mm broad enlarging slightly in fruiting stage. *Corolla* cream, pinkish or orange-brown on the upper side, inside of tube and base of lobes maroon spotted, pubescent outside; the hairs glandular and eglandular, the tube villous in the lower part and extending to the throat on the lowermost side; bulbous at the base, slightly constructed above the ovary, then dilating above; lobes 5, unequal, broadly acute to obtuse, pointed, the upper pair 2.5 mm long and broad, the lower 3, 5-6 mm long and broad, the lowermost one slightly reflexed. *Stamens* shortly exserted, as long as the lobes or at length slightly longer; filaments villous in the lower quarter; anthers glabrous. *Ovary* ovoid, tapering into style, densely glandular pubescent, about 3 mm long, 2 mm broad, 4(6) loculed, 1-2 ovules per loculus; style glandular pubescent except in the upper quarter. *Fruit* drupaceous, broadly ovoid more or less biangular, distinctly and unevenly ribbed, indumentum as for ovary but less dense, 7-8.5 mm long, 5.5-6 mm broad. Seed unknown.

Distribution

This species is restricted to the Gregory North and Gregory South Districts, Queensland (Map 1).

Specimens examined

Gregory South District — Currawilla about 100 miles W of Windorah, *S.L. Everist 4076*, 29.viii.1949 (BRI, CANB); Gregory North District 5 km N of Palparara, 24° 46′ S, 141° 26′ E, September 1977, *R.E. Isaacson 45* (AD, MEL); *R.E. Isaacson 48* (AD, MO).

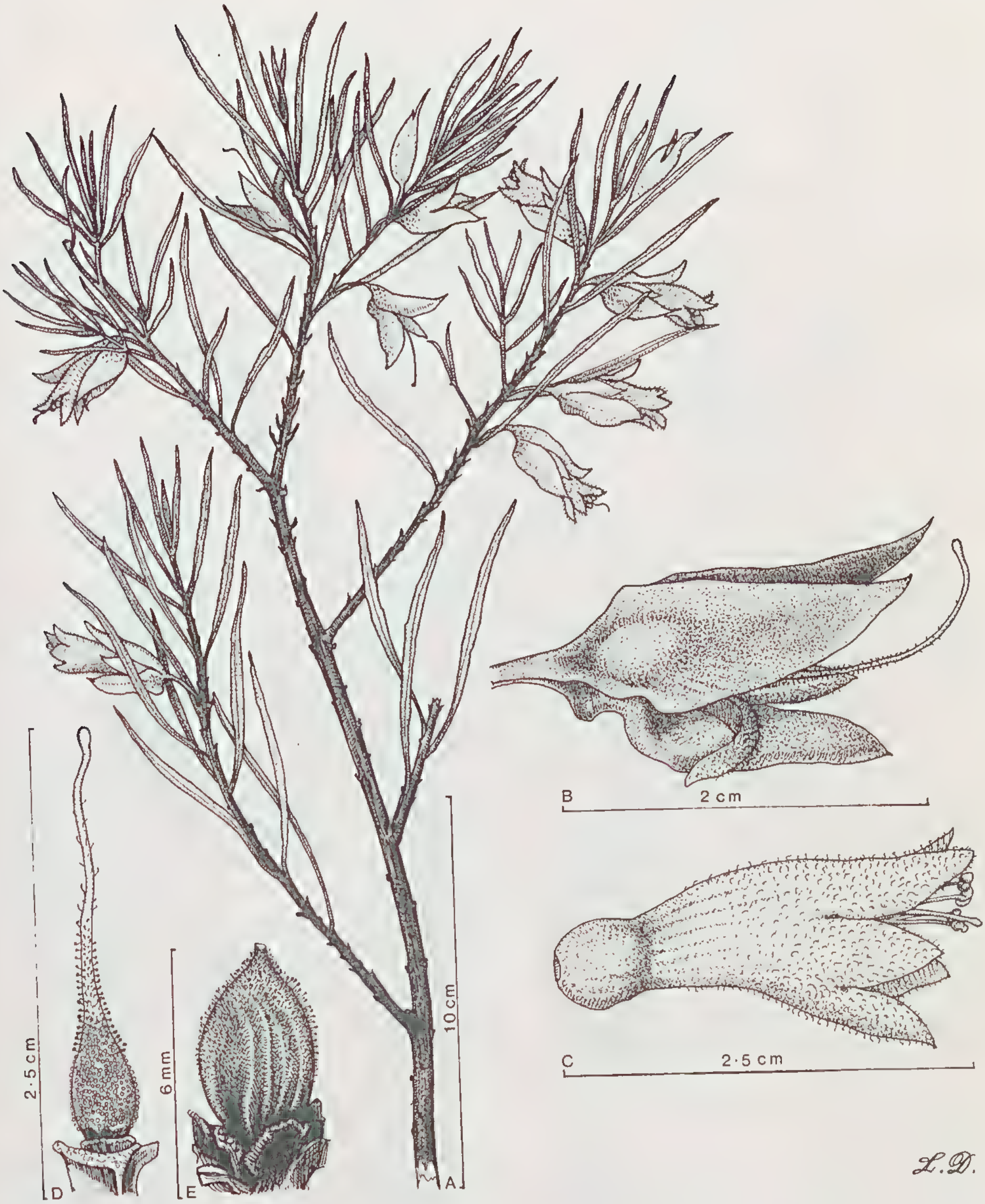


Fig. 3. *Eremophila alatisepala* Chinnock. A, habit; B, clayx showing position of basicentral attachment and wings extending down to the pedicel; C, corolla; D, gynoecium; E, slightly immature fruit. (A-E, *Isaacson 20*).

Affinities

The species does not appear to be closely related to any others although vegetatively the plant resembles forms of *E. clarkei* Oldfield & Muell., which also exhibits small wing-like extensions at the calyx base. The corolla types in the two species are, however, quite different. That of *E. alatisepala* approaches the type found in *E. longifolia* (R.Br.) F. Muell. while that of *E. clarkei* is typical of the blue-flowered species such as *E. freelingii* F. Muell. and *E. elderi* F. Muell.

E. alatisepala is largely restricted to stony slopes and ridges although it sometimes occurs on heavy red clay flats in surrounding areas.

4. **Eremophila bicolor** Chinnock sp. nov.

Ab *Eremophila maculata* (Ker) F. Muell. differt floribus brevibus, stylo breviore quam staminibus, apice stigmatis valde dilatato, fascia pilorum recipientium angusta et praesentia macularum in fructu immaturo. (Fig. 4)

Type: 1.5 km E of the Lake Cronin Crossroads on the Norseman road, 32° 25′ S, 119° 46′ E, 11.xi.1978, *R.J. Chinnock 4347* (holotype: AD; 150 type: CANB, K, MEL, PERTH, U.S.)

The specific epithet is derived from the strikingly different bud and open flower colours.

Shrub 0.3-1.6 m tall. *Branches* and branchlets ascending, glabrous, smooth except for a few irregularly scattered tubercules, more conspicuous in the older parts. *Leaves* alternate, indistinctly petiolate, spreading or secund, pale green, soft, thick, narrowly oblanceolate; apex acute, gradually tapering to the base, glabrous except for a minute glandular pubescence along the sunken midrib (upper side) and longer appressed eglandular hairs at the base of the petiole, (1.3-)1.8-4.3(-5) cm long, (2-)2.4-6(-8) mm broad. *Flowers* solitary in the leaf axils, pedicellate; pedicels straight or sigmoid, glabrous, 1.5-2 cm long. *Calyx* 5-partite, divided to base, imbricate in the lowermost part; segments subequal, glabrous outside, densely glandular pubescent within, ovate, 5-7 mm long, 2-2.5 mm broad, acuminate. *Corolla* (bud) orange above, yellow to yellowish-orange below. *Corolla* (mature) reddish-purple, slightly lighter beneath; pale whitish-purple inside with scattered darker purple flecks, glabrous outside, faintly verrucose above; glabrous within except for a few prominent long white arachnoid hairs on the lower portion of the lobes, the throat and uppermost portion of the tube; the hairs extending over the lower two-thirds of the lowermost lobe; tube 0.8-1.3 cm long, bulbous at the base for 3-5 mm constricted above the ovary, then gradually dilating, curved; lobes 5, upper 4 triangular, 4-5 mm long, lower lobe 9-10 mm long, ovate, acute, reflexed. *Stamens* 4, exserted; filaments curved or drooping, glabrous; anthers 2.5-3 mm long, glabrous. *Ovary* glabrous, green, weakly verrucose, ovoid 4-5 mm long, gradually tapering into style; style white, sparsely hirsute c. 2 cm long much shorter than stamens, abruptly dilating into a slightly compressed, sub-globular stigma; stigma yellow, with a pronounced transverse band of long receptive hairs. *Fruit* drupaceous, globular, slightly fleshy when immature, green, with prominent dark translucent spots, beaked; dry fruit 9-13 mm diameter, exocarp whitish-grey, papery; mesocarp dark brown, irregularly warted and fissured, woody; endocarp light brown, hard, woody; loculi 4, with one seed in each locule. Seed 4-5 mm long 1.5 mm broad, whitish-grey.

This species belongs to section *Stenochilus* (R.Br.) F. Muell.

Distribution

Western Australia — known only from the vicinity of the Lake Cronin Crossroads and Forrestania (Map 2). One collection made by Roe (undated) in the nineteenth century held at Vienna is labelled "K.G.S." which presumably is an abbreviation for King George's Sound, but it is highly unlikely that this species was collected in this vicinity. Roe did, however, lead an expedition to the "Interior of Western Australia" (Roe 1854) between September 8th, 1848 and February 3rd, 1849, which would have passed close to the known locations of this species, so it is possible that the reference to "K.G.S." is an error and the collection was made on this trip.

Fig. 4. *Eremophila bicolor* Chinnock. A, habit; B, flower showing prominent hairs on lower lip and short stigma; C, immature fruit showing prominent spotting; D, mature fruit with dried exocarp; E, F, transverse and longitudinal views of mature fruit (exocarp removed) showing the outer fissured and inner harder woody layers; G, front and side view of stigmatic apex of gynoecium to show the dilated nature of the apex and the prominent narrow band of receptive hairs. (A-G, cultivated plant, Adelaide, ex Kings Park).

Specimens examined

1.6 km E of Lake Cronin Crossroads 32° 25′ S, 119° 46′ E, *R.J. Chinnock 4143*, 25.ix. 1977, b, fr. (AD, PERTH); cultivated in Adelaide *R.J. Chinnock 4203*, Nov. 1977, fl. (AD); *R.J. Chinnock 4215*, 28.i.1978, fr. (AD); 9 km west of Forrestania, *C.A. Gardner 15896, 10.xii.1964, fl. (PERTH); Forrestania, H. Steedman a.n.*, Oct. 1930, fl. (PERTH); K.G.S., *Roe s.n.*, no date, fl. (W).

Affinities

Eremophila bicolor is related to *E. maculata* (Ker) F. Muell. It differs in its growth habit, glabrous branches, glabrous margins of the calyx segments, the shorter corolla tube, the stigmatic apex of the style and the prominently spotted immature fruits.

The well developed dilated stigmatic zone at the apex of the style, and the significantly shorter style are features unique to this species.

Another species, *E. laanii* F. Muell., superficially resembles *E. bicolor*, but it can be easily distinguished by its pubescent stems and leaves and its subsessile flowers.

5. **Eremophila purpurascens** Chinnock sp. nov.

Ab *Eremophila alternifolia* R. Br. differt foliis parvis obovatis et pedicello calyceque subtiliter glanduloso-pubescenti. (Fig. 5)

Type: Jimberlana Hill, 7 km NE of Norseman, Western Australia. 32° 09′ S, 121° 49′ E, *R.J. Chinnock 4184*, 28.ix.1977, fl. (holotype: AD; isotypes: CANB, K, MEL, PERTH, US).

The specific epithet is derived from the colour of the calyx-segments.

Shrub to 1.5 m tall. *Branches* and branchlets ascending, rigid, interlacing and sometimes more or less divaricate, glabrous, but densely covered with slightly raised glands, tuberculate. *Leaves* alternate, indistinctly petiolate, spreading, clustered, often only at the branch tips, glabrous but densely covered with sessile appressed glands, dark green, very thick and almost fleshy; lower surface with prominent tubercules, obovate to spathulate, apex obtuse, recurved, mucronate, gradually tapering to a cuneate base, (4.8-)7.5-12.0(-13.7) mm long, (2.1-)3-6(-7.4) mm broad (in cultivation leaves may be up to 24 mm long and 10 mm broad). *Flowers* solitary in the axils, pedicellate; pedicel sigmoid, purplish, densely pubescent, the hairs glandular and eglandular, occasionally sparsely tuberculate, sigmoid, 1-2.5 cm long. *Calyx* 5-partite, divided to the base, imbricate; segments unequal, greenish near the base and midrib otherwise purple, usually more intense along the margin, widely to very widely obovate, mucronate; glandular pubescent outside and within; margin irregular; 8-11 mm long, 6-8 mm broad. *Corolla* bud yellow, spotted purple, open flower light purple, darker purple spotted on the tube and lower lobe outside, inside yellow in the lower tube, otherwise purple, purple spotted on lowermost lobe and adjacent margins of throat or unspotted; sparsely glandular pubescent outside and within, tube short, 1-1.2 cm long, bulbous at the base, constricted above the ovary, dilating above into a narrow curved tube; lobes 5, upper 4 widely spaced, triangular, 4-7 mm long, 4-5 mm broad at the base, lowermost lobe 12-13 mm long, reflexed, apex acut to obtuse. *Stamens* 4, shortly exserted, glabrous; filaments 1.4-1.8 mm long; anthers about 2 mm long. *Ovary* glabrous, oblong, 2-2.5 mm long, loculi 4, 1 ovule per loculus; style glabrous, c. 2 cm long. *Fruit* drupaceous, conical, drying black, the exocarp wrinkled, 4-4.2 mm long, 2.5-3 mm broad at the base. Seed 2.2-2.3 mm long 0.5 mm broad, oblong, white.

This species belongs to section *Stenochilus* (R.Br.) F. Muell.

Fig. 5. *Eremophila purpurascens* Chinnock. A, habit; B, upper and lower leaf surface, respectively; C, flower; D, mature fruit; E, gynoecium. (A-C, E, *Chinnock 4184;* D, *Donner 4642).*

Distribution

Western Australia — restricted to the granite hills around Norseman (Map 2).

Specimens examined

0.5 m N of Causeway, Norseman, 32° 10′ S, 121° 45′ E, *J.S. Beard 5201*, 24.x.1967, fl. fr. (KP, PERTH); ca. 5 km NE of Norseman, P.O. ca. 1 km N of Eyre Highway, *A.C. Beauglehole 49379*, 29.viii.1974, fl. (AD); Hills 7 miles from Norseman, *W.E. Blackall 1222*, 30.x.1931, fr. (PERTH); Hills near Norseman, *W.E. Blackall 1224*, Oct. 1931, fl. fr. (PERTH); Norseman, *W.D. Campbell s.n.*, Oct. 1904, fr. (PERTH); south-western side of Lake Cowan, 1 km S of Causeway, 32° 10′ S, 121° 44′ E, *R.J. Chinnock 3035*, 11.ix.1976, v. (AD); Jimberlana Hill, 7 km NE of Norseman, 32° 09′ S, 121° 49′ E, *R.J. Chinnock 3328*, 10.x.1976, b. (AD); *R.J. Chinnock 4185*, 28.ix.1977, fl. (AD, BRI, NT); ca. 5 km NE of Norseman at Jimberlana, 32° 09′ S, 121° 48′ E, *N.N. Donner 4642*, 9.ix.1973, fl. fr. (AD); Norseman Hills, *C.A. Gardner 2921*, 27.ix.1931, fr. (PERTH); Norseman, *C.A. Gardner 2922*, 29.x.1931, fl. (PERTH); ca. 8 km NE of Norseman, 32° 10′ S, 121° 47′ E, *D.J.E. Whibley 4578*, 29.x.1974, fl. fr. (AD, PERTH); no details, *M.M. McCole 7032*, no date, fl. (PERTH).

Affinities

Eremophila purpurascens is related to *E. alternifolia*. Both species have glabrous branches and leaves covered with sessile glands, prominently spotted stenochiloid flowers, shortly exserted anthers and small conical fruits. *E. purpurascens* differs from *E. alternifolia* in the more densely tuberculed branches, size and shape of the leaves, the presence of raised tubercules on the under side of the leaves, the densely glandular pubescent pedicel and calyx-segments. The two species form a well defined unit within section *Stenochilus*.

6. **Eremophila gibbosa** Chinnock sp. nov.

Ab *Eremophila serrulata* (A. Cunn. ex A.DC.) Druce differt ramis foliisque glabris, caespite pilorum denso in apice segmentorum calycis et fructu obovoideo apice depresso. (Fig. 6).

Type: 9.2 km SSE of Norseman just S of Woolyeenyer Hill, Western Australia. 32° 17′ S, 121° 48′ E, *R.J. Chinnock 3323*, 10.x.1976 (holotype: AD; isotypes: CANB, K, MEL, US, PERTH).

The specific epithet refers to the pronounced swelling of the upper portion of the fruit.

Shrub 0.5-3.2 m tall with ascending or erect branches, root suckering and sometimes forming dense thickets. *Branchlets* glabrous, terete, or slightly flattened, pale brown, glands, extremely viscid, shiny. *Leaves* alternate, glabrous or with a tuft of whitish-yellow hairs at the apex, especially when young, distinctly petiolate; petiole (0.28-)0.4-0.8(-1.0) cm long; blade ovate to elliptic more rarely widely elliptic; obtuse or broadly acute at the apex, mucronate; the base widely cuneate; margins entire or obscurely serrate, surfaces covered with numerous sessile glands, usually obscured by resin, extremely viscid, shiny or vernicose when fresh, (0.95-)1.5-3.5(-4.5) cm long, (0.4-)0.7-1.8(-2.2) cm broad. *Flowers* solitary, axillary, pedicellate; pedicel sigmoid, glabrous, papillose, viscid, 1-1.5 cm long; *calyx* 5-partite; segments imbricate, green or purplish, oblong to obovate, apex obtuse, mucronate, glabrous except for a dense white tuft of hair at the apex, especially on the inner surface, 6-7 mm long, 1.5-3 mm broad becoming only slightly enlarged and reticulated at fruiting stage. *Corolla* yellowish-green, the tube sparsely glandular pubescent, the 4 upper lobes moderately densely pubescent the hairs crisped, eglandular; bulbous at the base, very slightly constructed above the ovary, expanding into a narrow curved tube; lobes unequal the upper 4, small obtuse, the lower lobe deeply cut into tube to half its length, reflexed, apex acute obtuse, bilobed, with numerous crisped hairs near the apex and along margins. *Stamens* 4, exserted; filaments white, glabrous, the upper pair shorter about 2 cm long; anthers glabrous, brownish-yellow, 1.5-2 mm long, 1 mm broad. *Ovary* glabrous, oblong-ovoid, obtruse, loculi 4, 1 ovule per loculus, style sparsely hirsute, about 2 cm long, apex notched. *Fruit* drupaceaous, glabrous, subglobose, apex truncate or depressed, more or less bilobed, the two lobes slightly separating and more or less incurved, beaked at the styler edge, touching and often forming a small sinus beneath; exocarp grey, wrinkled; 3-4 mm long and broad. *Seed* white, about 2 mm long 0.7-0.9 mm broad.

This species belongs to section *Stenochilus* (R.Br.) F. Muell.

Fig. 6. *Eremophila gibbosa* Chinnock. A, habit; B, enlargement of branch to show tubercules; C, leaves; D, calyx-segments, inner and outer surfaces, respectively; E, flower; F, seed; G, mature fruit with style still attached (note sinus below style); H, longitudinal view through fruit; I, apex of mature fruit showing sinus and touching beaks after the style is lost. (A-I, *Chinnock 3324*).

Distribution

Western Australia, Coolgardie District extending from the Fraser Range to the Norseman, Coolgardie and Kalgoorlie areas (Map 3).

Representative specimens

6 km E of Norseman, *B.A. Barlow 1580,* 18.vi.1969, b, fl. (AD); 1 mile S of Broad Arrow, *B.A. Barlow 1593,* 19.vi.1969, b, fl. (AD); 2 miles S of Norseman, *J.S. Beard 6341,* 15.ix.1970, fr. (PERTH); 14 miles SE of Coolgardie, *N.T. Burbidge s.n.,* 19.iv.1947, fr. (CANB 14464); 9.2 km SSE of Norseman, just S of Woolyeenyer Hill, 32° 17′ S, 121° 48′ E, *R.J. Chinnock 3007,* 10.ix.1976 (AD, PERTH); 35.5 km SSW of Coolgardie, just S of Gnarlbine Rock, 31° 11′ S, 120° 56′ E, *R.J. Chinnock 3076,* 16.ix.1976, imm. fr. (AD); Western edge of Fraser Range, 100.8 km E of Norseman, 32° 02′ 30″ S, 122° 44′ E, *R.J. Chinnock 3340,* 11.x.1976, fr. (AD, PERTH); 46.7 km WSW of Coolgardie, 31° 06′ 30″ S, 120° 44′ E, *R.J. Chinnock 3668,* 8.viii.1977, fl.fr. (AD); Near McPherson Rock, 31 km S of Norseman *M.D. Crisp 978,* 8.viii.1975, b, fl. (CBG); Coolgardie, *R. Helms s.n.,* July 1899, fl. (AD); Fraser Range, *M.E. Phillips s.n.,* 3.ix.1968, fl.fr. (CBG 023245); Beacon Hill, Norseman, *M.E. Phillips s.n.,* 4.ix.1968, fl. (CBG 026169); 16.1 km from Coolgardie towards Southern Cross, *M.E. Phillips WA68/486,* 5.ix.1968, fl.fr. (CBG); Coolgardie, *C.A. White s.n.,* Aug. 1897, imm. fr. (PERTH).

Chromosome Number: n = 18 (Barlow 1971, *E. serrulata* p.p.).

Affinities

Eremophila gibbosa is closely related to *E. virens* Gardner. Both species have glabrous vegetative parts except for the upper side of the petiole and the leaf apex but differ in the size and shape of the leaves and calyx-segments. They exhibit remarkable similarities in the flower and fruit. The corolla of *E. virens* is densely pubescent outside, the hairs crisped while *E. gibbosa* has a sparsely pubescent corolla except for the lobes. Glandular hairs are present on the corolla of *E. gibbosa.* In both species the calyx is glabrous except for a dense white tuft of hairs on the inner surface near the apex of the segments. This is more extensive in *E. virens.* Both species have fruits of similar size and shape.

Although *E. gibbosa* is closely related to *E. virens* it has usually been included under *E. serrulata* A. Cunn. ex Benth. These three species together with at least one other undescribed one form a well defined group of green flowered species within section *Stenochilus. E. serrulata* is an extremely variable and widespread species extending from Western New South Wales through Central and South Australia to Western Australia. The leaves of this species range from ovate, elliptic to suborbicular and are comparable in size and shape with *E. gibbosa.* However, the presence of hairs on the leaves and stems, the absence of a dense white tuft of hair at the apex of the calyx segment and the globular fruit readily distinguish this species from *E. gibbosa.*

Ecology

The three species, as far as I am aware, do not overlap in distribution. *E. gibbosa* occurs on red clay loams and on rocky hills in the Norseman-Coolgardie area and extends just slightly north of Kalgoorlie; *E. virens* is restricted to the Campion area north of Merredin and *E. serrulata* occurs on rocky slopes and outcrops in areas to the north and east of Campion. Both *E. virens* and *E. gibbosa* appear to favour disturbed sites, and the latter species is particularly common on road sides.

Cultivation

This species is now becoming widespread in the Adelaide region. It will establish from cuttings, but is more easily obtained from the numerous root suckers which develop readily.

7. **Eremophila serpens** Chinnock sp. nov.

Ab *Eremophila serrulata* (A. Cunn. ex A. DC.) Druce differt absentia pilorum stellatorum in folliis ramisque, pedicello brevi, calyce parvo, fascia in corolla brunneola et filamentis styloque purpureo. (Fig. 7).

Type: 18 miles (c. 29 km) east of Newdegate on the Lake King road, Western Australia. *A.S. George 9283,* 25.iv.1969, fl. fr. (holotype: PERTH; isotypes: CANB, AD, K).

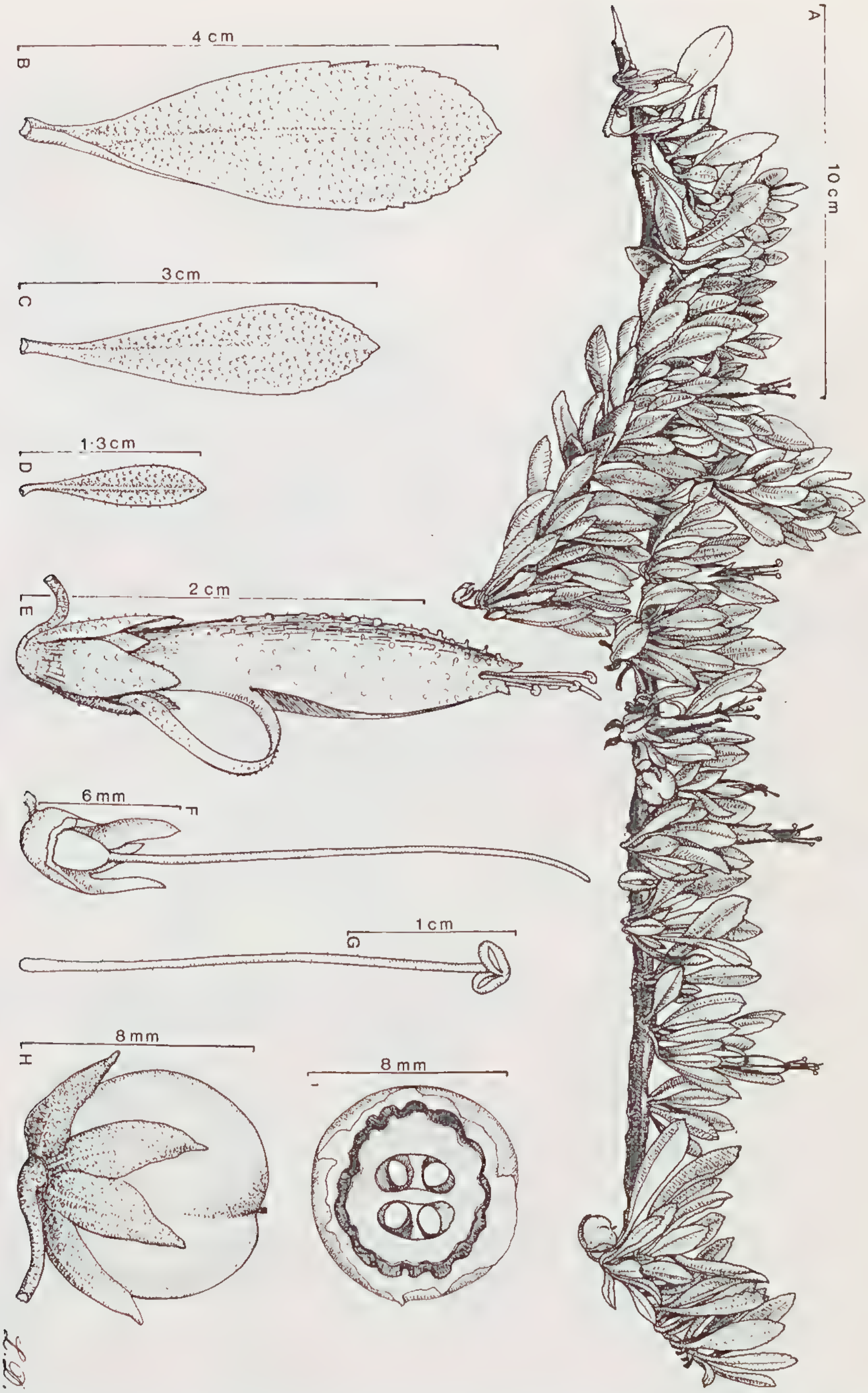


Fig. 7. *Eremophila serpens* Chinnock. A, habit; B-D, leaf variation on one plant; E, flower showing prominent tubercules on the corolla; F, gynoecium; G, stamen; H, I, side view and cross-section of mature fruit and note the papery exocarp separated from the inner layers. (A.-H, cultivated plant, Adelaide Botanic Gardens).

The specific epithet is taken from the prostrate habit.

Stems and branches prostrate, creeping and forming large patches, glabrous; at first purple, slightly fleshy, irregularly tuberculate, 3.5-5 mm diameter; becoming woody in the older parts, 1.5-2.5 cm diameter, pale brown; rooting freely at nodes except in the youngest parts; lateral branches of limited growth or forming normal long stems. *Leaves* alternate, indistinctly petiolate, erect or slightly spreading, glabrous, oblanceolate, serrate in the upper half often irregularly so, apex broadly acute, blade gradually tapering into an indistinct petiole, cuneate, surfaces densely covered with slightly raised glands when fresh, prominently punctate when dried, (3.1-)3.2-4.3(-4.7) cm long, (0.5-)0.85-1.2(-1.4) cm broad. *Flowers* solitary or 2-nate, erect, axillary along the main stems or on the short lateral branches often obscured by the leaves and only the upper portions of the stamens and gynoecium visible, pedicellate; pedicel rugose, (4-)5-7(-10) mm long. *Calyx* 5-partite, unequal, outer segments lanceolate, acute, 6-7 mm long, 2.0-2.5 mm broad, enlarging in fruiting stage to 10-11 mm long, 3.0-3.5 mm broad, remaining herbaceous; inner segments slightly narrower and shorter; surfaces glabrous, viscid, margins especially in the upper part with glandular, simple and branched eglandular hairs. *Corolla* lime green, dark brownish-purple on the upper lip extending in a band from the two uppermost lobes down the tube, glabrous outside and within except for scattered glandular hairs on the inside of the lowermost lobe and adjacent tube; 2-2.6 cm long, markedly tuberculate; bulbous at the base constricting slightly above the ovary then expanding into a narrow tube; lobes unequal the upper 4 acute, 2-2.5 mm long, the lower lobe deeply cut into the tube, recurved, when straightened reaching the apex of the lower upper lobes, apex more or less pouched. *Stamens* 4, exserted; filaments purple, lighyter towards the base, sparsely glandular pubescent, the lower pair slightly longer c. 3 cm; anthers purplish-black, small c. 1.5 mm long, 1 mm broad; *ovary* oblong, glabrous, green, 2 mm long, 1 mm broad, slightly compressed, dilating at the base into a broad disk (nectary), loculi 4, 1 ovule per loculus; style purple to base, glabrous. *Fruit* drupaceous, globular 7-9 mm diameter, exocarp papery, grey, mesocarp brown, rugose. *Seed* pale brown, oblong-ovoid c. 2.5 mm long, 1 mm broad.

This species belongs to section *Stenochilus* (R.Br.) F. Muell.

Distribution

Western Australia, Coolgardie District; known only from the Hyden-Lake King-Newdegate area (Map 2).

Specimens examined

Cultivated at Adelaide Botanic Gardens, *R.J. Chinnock 4218*, Feb. 1978, fl. fr. (AD); Newdegate — Lake King road, *F.W. Humphreys s.n.*, 30.v.1964, fl. (PERTH); 23 miles W of Lake King, *F. Lullfitz 3942*, 29.xi.1964, fl. frl. (PERTH).

Cultivation

See under *Eremophila biserrata.*

8. **Eremophila biserrata** Chinnock sp. nov.

Ab *Eremophila serpenti* differt ramis pubescentibus, foliis biserratis pilis in petiolo, corrolla pubescenti et fructu pyriformi (Figs 8, 9).

Type: On track 4 km N of the Hyden-Lake Cronin road, 5.5 km W of Lake Cronin crossroads, Western Australia. 32° 23′ S, 119° 41′ E, *R.J. Chinnock 3250*, 6.x.1976, fl. (holotype: AD97704248; isotypes: AD, CANB, K, NY, PERTH).

The specific epithet is derived from the biserrate nature of the leaves.

Stems and branches prostrate, creeping and forming large patches, densely glandular pubescent, becoming woody and longitudinally fissured, light brown 3-5 mm diameter, rooting freely at nodes except in the youngest parts; lateral branches of limited growth or developing into normal long stems. *Leaves* alternate, petiolate, erect or slightly spreading,

Fig. 8. *Eremophila biserrata* Chinnock A, habit of whole plant (small); B, flower in axil of leaf; C, D, mature fruit; E, cross-section of fruit (exocarp removed); F, seed. (A-F, *Chinnock 3250*).

clustered, on the lateral shoots rosetted, glandular pubescent especially on the petiole, the lower part of the blade and the margin, oblanceolate to spathulate, margins biserrate and sometimes deeply incised, apex obtuse to almost truncate often distinctly trifid, blade gradually tapering into petiole, cuneate, surfaces glandular punctate, (1.4-)1.8-2.4(-2.8) cm long, (-0.35)0.5-0.9(-1.1) cm broad. *Flowers* solitary, erect, axillary along the main stems or on the short lateral branches, often obscured by the leaves and only the upper portions of the stamens and gynoecium visible; pedicel glandular pubescent, 3-5(-7) mm long, receptacle bulbous, glandular pubescent, ribbed. *Calyx* 5-partite; segments imbricate, glandular pubescent outside and within; outer 3 segments oblong-acute 4-5 mm long, 1.5-2 mm broad, inner segments narrower, 1 mm broad. *Corolla* lime green to yellowish-green, dark brownish-purple on the upper lip extending in a band from the two uppermost lobes down the tube, glandular pubescent outside and within; slightly tuberculate in the vicinity of the 4 upper lobes; bulbous at the base, constricted above the ovary then expanding into a narrow tube; lobes unequal, the upper 4 small, acute, the lower one linear-oblong deeply cut into tube, straight or very slightly recurved, not reaching the base of the upper lobes apex truncate. *Stamens* 4, exserted; filaments purple; sparsely glandular pubescent; the upper pair shorter c. 2-5 cm long; anthers purplish-black, small 1.2-1.5 mm long, c. 1 mm broad. *Ovary* glabrous, green, c. 1.5 mm long, 0.8 mm broad at the base, laterally compressed; loculi 4, 1 ovule per loculus; style purple, glabrous, stigmatic apex slightly dilated, yellow. *Fruit* drupaceous, 4.5-5 mm long 3-4 mm broad, oblong to pear-shaped, irregularly ribbed in the lower part, apex obtuse, partially splitting, and often beak-like; exocarp papery, grey, mesocarp blackish-brown faintly rugose. *Seed* pale yellowish-brown, ovoid, c. 2.5 mm long, mm broad at base.

This species belongs to section *Stenochilus* (R.Br.) F. Muell.

Distribution

Western Australia, Coolgardie District, known only from the Hyden-Forrestania-Lake King area.

Specimens examined

3 km E of Hyden near road junction to Wave Rock, 32° 27′ S, 118° 50′ E, *R.J. Chinnock 4127*, 25.ix.1977, fl. fr., (AD, PERTH, NSW), *R.J. Chinnock 4128*, 25.ix.1977, fl. fr. (AD); Lake Cronin, 32° 23′ S, 119° 46′ E, *A.S. George 15105*, 14.iii.1978, fl. (PERTH); Lake Cronin, 3.5 miles N of Crossroads, *F. Lullfitz 13846*, 25.xi.1964, fl. fr. (PERTH, KP).

Ecology

This species favours open situations on sandy or sandy clay saline soils. At the type locality plants were common on light brown sandy clay loams on outwash plains amongst regenerating mallee and numerous low growing Acacias.

Near Hyden (*Chinnock 4127*) it was found growing amongst *Eucalyptus* and *Melaleuca* spp. on a shallow rise in a saline depression. Associated ground species were *Disphyma clavellatum* (Haw.) Chinnock, *Atriplex* spp. and *Arthrocnemum* spp. The soil was particularly sandy with a small amount of organic detritus in the surface horizon. Lower horizons became progressively clayey.

Cultivation

E. biserrata and *E. serpens* are readily grown from cuttings and have been known in the Adelaide region for many years. They are excellent ground cover species and thrive on the alkaline soils of the Adelaide plains.

Affinities

Eremophila serpens and *E. biserrata* form a small but well defined group within section *Stenochilus*. The prostrate stems which root freely at nodes, the erect flowers with a curious colour combination make them quite unique. The predominently yellowish-green corolla and leaf features suggest that they are probably related to the *E. serrulata* group of species which includes *E. serrulata*, *E. gibbosa* and *E. virens*.

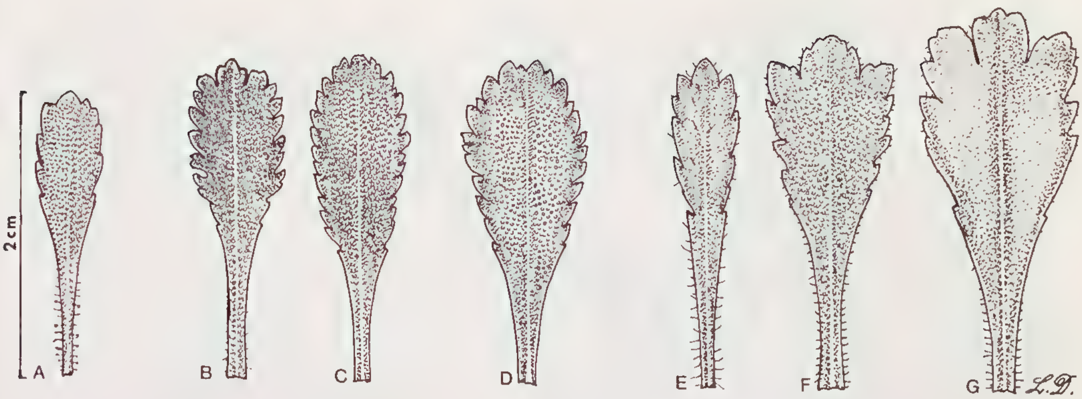


Fig. 9. *Eremophila biserrata* Chinnock. A-G, leaf variation. (A, *Chinnock 4127;* B, C, *Chinnock 3250;* D, *Lullfitz 3846;* E-G, *Chinnock 4128*).

9. **Eremophila verrucosa** Chinnock sp. nov.

Eremophilae scopariae (R.Br.) F. Muell. affinis est sed differt squamis in ramis tubercula non tegentibus, foliis dense fasciculatis tuberculatis, corolla stellate pilosa et fructu piloso. (Fig. 10).

Type: Copper Hills 28° 00′ S, 134° 26′ E, Lake Eyre Basin, South Australia. Stoney slopes from creek flats to below flat tops. Common in Homestead area, *B.J. Knight 259,* 21.i.1978, fl. (holotype: AD; isotypes: CANB, MEL, NT, K, NY, MO).

The specific epithet refers to the prominently verrucose branches.

Shrub, erect or intricate, 1-2 m high. *Branches,* lepidote, densely tuberculate, tubercules not covered by the scales, evenly dispersed or in rows, orange-brown, translucent; internodes 2.5-4 mm. *Leaves* opposite, decussate, clustered, indistinctly petiolate, spreading, densely lepidote, narrow linear-lanceolate to narrow elliptic, channelled above and keeled below or flattened, sigmoid or straight in side view, (0.5-)1.0-1.4(-1.6) cm long 1.4-2.2 mm broad. *Flowers* solitary or paired, axillary, shortly pedicellate; pedicel compressed, densely lepidote 1.5-2.5 mm long. *Calyx* 5-partite, segments imbricate near the base, almost equal, densely white lepidote outside, densely glandular pubescent within except in the lower quarter, and with branched hairs along the margin near the apex, narrow linear-lanceolate, 2.5-5.5 mm long, 1.2-1.5 mm broad. *Corolla* lilac to mauve, dark purple spotted in lower part of tube above the construction and extending along the tube on the lower side to the base of the lowermost lobe, c. 1.5-2.2 cm long, densely stellate pubescent outside; the hairs interlacing or discrete, arachnoid hairy within the tube, densely hirsute at the construction around the filament bases, lobes glabrous; the tube at the base cylindrical for 4-5 mm then abruptly expanding into an oblique, laterally compressed, campanulate cup; lobes 5, unequal, obtuse, the lowermost dilated, 3.4-5 mm long, 2.5-3.5 mm broad. *Stamens* included; filaments white sparsely or densely bearded at the base otherwise glabrous; anthers yellow c. 2.2 mm long; with an intramarginal band of crisped arachnoid hairs. *Ovary* oblong-ovoid, c. 2 mm long, tomentose to lanate, 4 loculed 1 ovule per loculus; style 1.2-1.5 cm long, densely villous in the lower part, sparsely hairy above. *Fruit* drupaceous, ovoid to broadly ovoid, hard, 4.5-5 mm long, tomentose to lanate. *Seed* unknown.

This species belongs to section *Pholidia* (R.Br.) F. Muell.

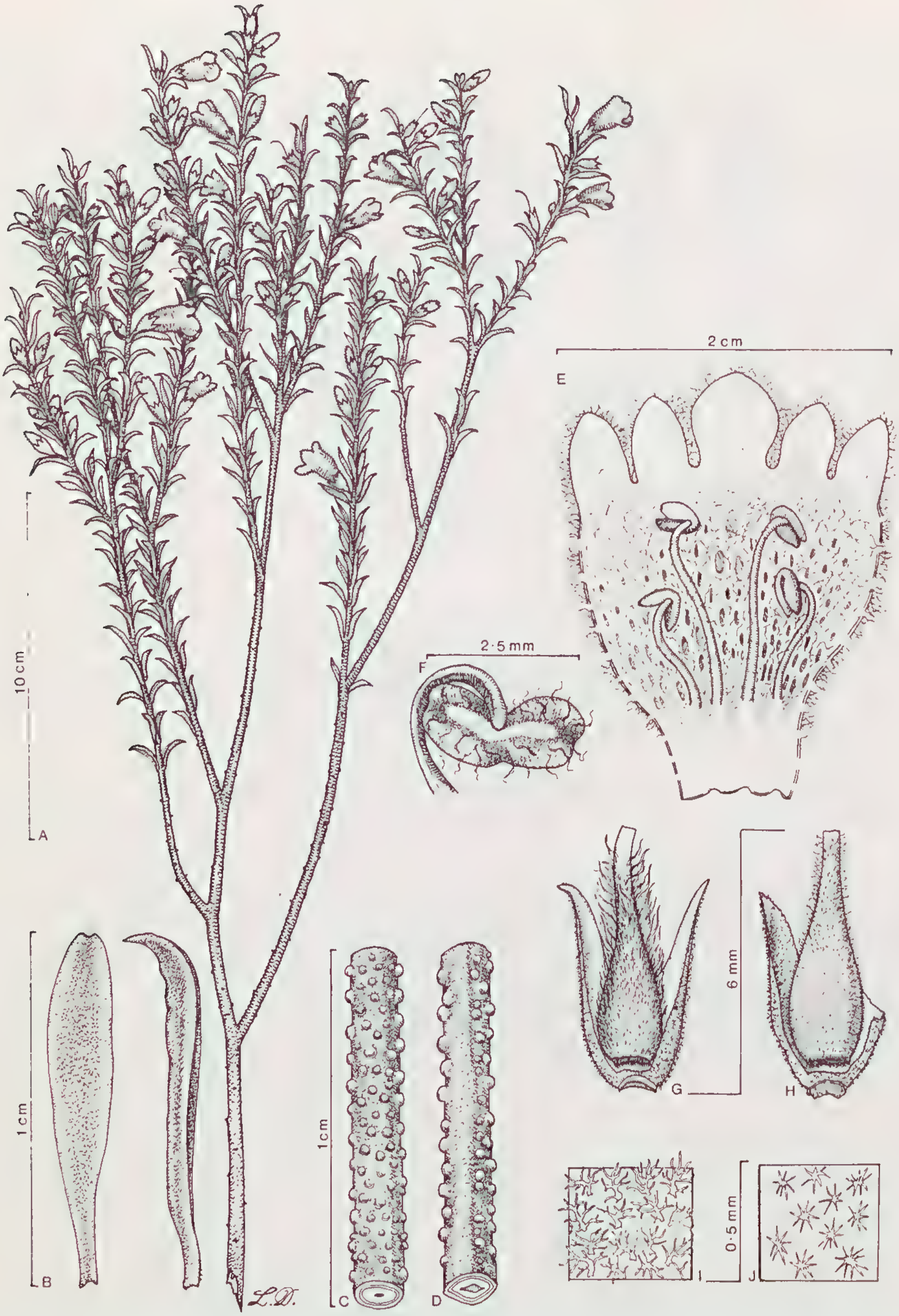


Fig. 10. *Eremophila verrucosa* Chinnock ssp. *verrucosa* (A-C, E-G, I) and ssp. *brevistellata* Chinnock (D, H, J). A, habit; B, leaf front and side view; C, D, enlargement of branch to show tubercule arrangement; E, opened corolla; F, anther showing hairs on the back; G, H, ovary and lower style showing hairs; I, J, hairs on corolla. (A-C, E-G, I, *Clark-Edwards s.n. (AD97556119)*; D, H, J, *Whibley 737*).

Affinities

Eremophila verrucosa is closely allied to the widespread *E. scoparia* (R.Br.) F. Muell. and replaces it to the north in South Australia. It may be distinguished from *E. scoparia* by the scales not covering the numerous tubercules on the branchlets; the stellate pubescent corolla; intramarginal hairs on the anther backs and the densely tomentose to lanate ovary.

ssp. **verrucosa**

Corolla with hairs stellate, interlacing, with rays usually branched and longer than in ssp. brevistellata.

Distribution

South Australia. North-Western, Lake Eyre Basin and Nullarbor Regions (Map 1).

Specimens examined

Copper Hill on the Evelyn Creek, 27° 57′ S, 133° 20′ *E.M. Clarke-Edwards s.n.*, 23.xi.1975, fl. (AD); As above 25.xi.1975, fl. fr. (AD, WELT, WIR, WRSL, Z, ZT): Evelyn Downs, ca. 120 km SW of Oodnadatta, *E.H. Ising s.n.*, 20.xi.1924, fl. (AD); Stuart Range c. 70 km NNW of Millers Creek Homestead on dog fence, 29° 39′ S, 135° 46′ E, *B.G. Lay 627*, 10.x.1971, fl. (AD); Copper Hill near Homestead, *F. & R. Mason s.n.*, 12.v.1977, fl. (AD 978274260; Wilkinson Lakes, ca. 100 km NE of Maralinga, *R.C. Shearer 40, 43*, 14.ii.1972, fr. (AD).

ssp. **brevistellata** Chinnock ssp. nov.

Corolla pilis stellatis discretis, radiis simplicibus brevioribus quam in ssp. *verrucosa*.

Type: Ca. 2 km E of Ooldea, South Australia. *D.J.E. Whibley 737*, 21.ix.1960, fl. (holotype: AD; isotypes: CANB, NSW, UC).

The sub-specific epithet refers to the short-rayed stellate hairs of the corolla.

Corolla with hairs stellate, discrete, with rays simple and shorter than in ssp. *verrucosa*.

Distribution

South Australia. Nullarbor region. Known only from near Ooldea (Map 1).

Other specimen examined

Ca. 1 km E of Ooldea, South Australia. *P. Wilson 1181*, 22.ix.1960, fl. (AD).

Ecology

The two subspecies appear to favour different soil types. *E. verrucosa* ssp. *verrucosa* is abundant on skeletal soils on rocky slopes around Copper Hill, whereas *E. verrucosa* ssp. *brevistellata* is known only from red sandy loams (or possibly sandhills) overlying limestone just east of Ooldea.

10. **Eremophila arachnoides** Chinnock sp. nov.

Ab *Eremophila dalyana* F. Muell. differt foliis ramisque glabrescentibus, corolla stellate pubescenti, antheris hirsutis et fructu succulento. (Fig. 11).

Type: 16.6 km SE of Yarrabubba Homestead, Western Australia. 27° 12′ S, 118° 52′ E, *R.J. Chinnock 3995*, 15.ix.1977 (holotype: AD; isotypes: CANB, K, PERTH, NY).

The specific epithet refers to the arachnoid hairs of the corolla.

Broom-like shrub to 3 m tall. *Branches* ascending, densely white lepidote at first, glabrescent, more or less 4-angled at first, terete in older parts, tuberculate; the tubercules circular and discreet, or elongated and often coalescing to form irregular ridges, internodes (3-)4-10 mm. *Leaves* opposite, indistinctly petiolate, erect or spreading, densely white lepidote at first, becoming sparsely lepidote or nude, narrow linear, terete or subterete and channelled above, straight or more or less sigmoid in side view or sharply recurved in the upper part, uncinate, (1.4-)1.9-3.1(-3.2) cm long, 0.7-1 mm broad. *Flowers* solitary or paired, axillary, pedicellate; pedicel 1-3.5 mm long, white lepidote. *Calyx* 5-partite, lepidote outside,

Fig. 11. *Eremophila arachnoides* Chinnock ssp. *arachnoides*. A, habit; B, enlargement of portion of branch showing tubercule arrangement, leaf and flower; C, gynoecium; D, anther showing hairs on back; E, F, transverse and longitudinal views through fruit to show fleshy mesocarp with resin cavities. (A-F, *Chinnock 4003*).

glabrous inside except near the apex, margins and apex hirsute. *Corolla* white to mauve (0.9-) 1.5-2.0(-2.4) cm long; densely white stellate pubescant outside, inside tube with short crisped arachnoid hairs, the hairs denser down the tube below the lowermost lobe, the lobes with short crisped hairs; the tube at the base cylindrical for 5-6 mm, abruptly dilating into a laterally compressed campanulate cup; lobes 5, subequal, obtuse, 2.5-3 mm long and wide. *Stamens* included; filaments bearded at the base; anthers yellow, 2-2.2 mm long, with a dense intramarginal band of crisped hairs. *Ovary* narrow ovoid, densely hairy, the hairs stellate or branched, 2-2.5 mm long, tapering into style, locules 4, usually 2 ovules per locule. *Fruit* drupaceous, rose pink, succulent sparsely pubescent at maturity, ovoid, drying dark grey or reddish, wrinkled, (5.2)5.5-6.5 mm long, 3.5-4.5 mm wide, 4 locular. *Seed* whitish, ovoid, 2.7 mm long 0.8 mm broad.

This species belongs to section *Pholidia* (R.Br.) F. Muell.

Affinities

Eremophila arachnoides is closest to *E. dalyana* F. Muell. which replaces it in the north-east of South Australia and extends into the Northern Territory and Queensland. The two species differ in the indumentum of the corolla, the presence or absence of hairs on the anther backs and the fruit shape, size and succulence. The fruit of *E. dalyana* is dry, whereas at least in the type subspecies of *E. arachnoides* it is succulent. *Eremophila arachnoides, E. dalyana* F. Muell., *E. pantonii* F. Muell., *E. scoparia* (R.Br.) F. Muell. and *E. verrucosa* form a very well defined group within section *Pholidia* differing from the other species of the section by the presence of a lepidote indumentum on the vegetative parts and at least the pedicel and calyx of the flower.

ssp. **arachnoides**

Branches with tubercules circular, discrete; *ovary* with hairs stellate.

Distribution

Western Australia (Map 2).

Specimens examined

12 km SSE of Yarrabubba Homestead 27° 12′ S, 118° 53′ E, *R.J. Chinnock 1045*, 14.ix.1973, fl. (AD); 12.2 km SSE of Yarrabubba, 16.ix.1977, *R.J. Chinnock 4002*, fl. (AD); *R.J. Chinnock 4003*, fl. fr. (AD); *R.J. Chinnock 4004*, fl. (AD).

ssp. **tenera** Chinnock ssp. nov.

Rami tuberculis saepe elongatis coalescentibusque ovarium pilis ramosis.

Type: 32 km W of Wynbring near the Mt Christie Siding, South Australia. 30° 33′ S, 133° 12′ E, *R.J. Chinnock 2639*, 28.ix.1975, fl. (holotype: AD; isotypes: A, K, PERTH).

The subspecific epithet refers to the long slender leaves.

Branches with tubercules often elongated and coalescing; *ovary* with branched hairs.

Distribution

Western and South Australia (Map 2).

Specimens examined

WESTERN AUSTRALIA. Erliston Creek, Bandya Station, *E. Oliver and T. Muir per Ashby 3946*, Aug. 1971, fl. (AD).

SOUTH AUSTRALIA. 150 miles N of Cook, *J.R. Ford s.n.*, May 1969, fl. (PERTH); Lake Meramange, 28° 29′ S, 132° 08′ E, *N. Ford 559*, 22.ix.1956, fl. (CANB, AD); 11 m S of Emu, *N. Ford 405*, 27.viii.1956, fl. (CANB); About 300 miles NW of Woomera, *F.L. Hill 183*, 10.x.1953, fl. (CANB); Barton, Nullarbor Plain, *E.H. Ising s.n.*, 17.ix.1926, fl. (AD 966080706); Commonwealth Hill Station, ca. 60 km NW of Wynbring Siding *B. Lay 671*, 26.ix.1971, fl. (AD, MO); ca. 80 km SE of Mt Lindsay, *R.B. Major* 9, 1966, fl. (AD).

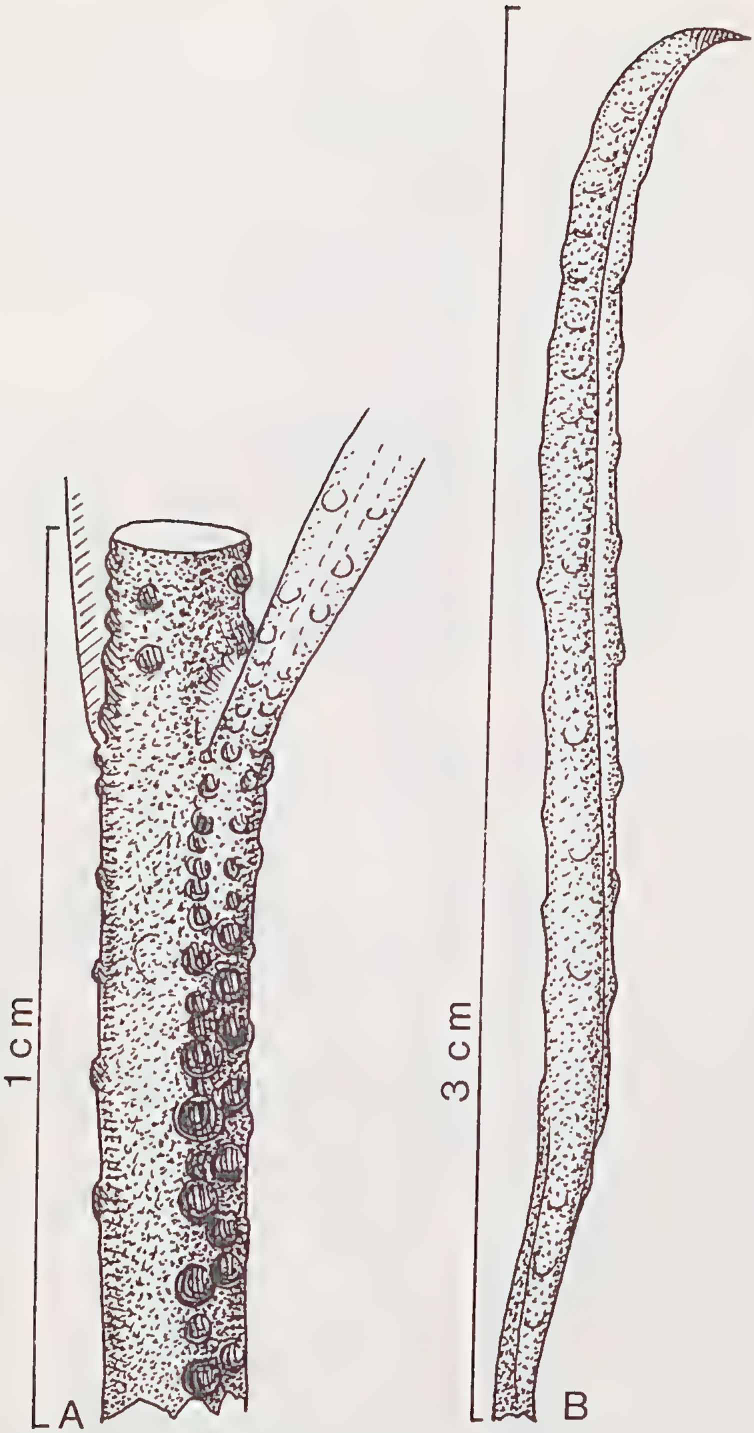
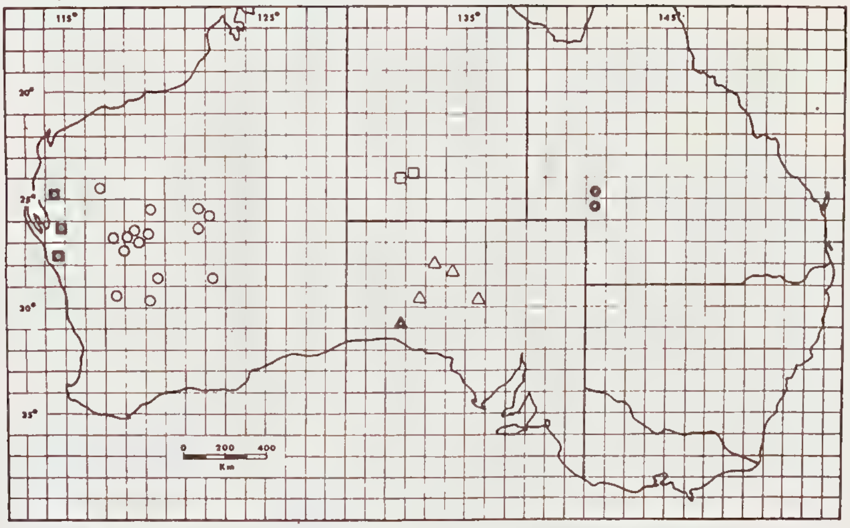


Fig. 12. *Eremophila arachnoides* ssp. *tenera* Chinnock. A, portion of branch showing coalescing tubercules; B, leaf.



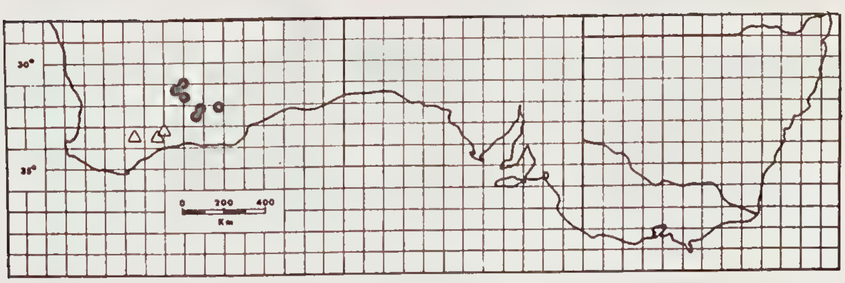
● E. alatisepala
○ E. glutinosa
□ E. ovata
■ E. strongylophylla

△ E. verrucosa ssp. verrucosa

▲ E. verrucosa ssp. brevistellata

● E. arachnoides ssp. arachnoides
○ E. arachnoides ssp. tenera
▲ E. bicolor

■ E. purpurascens
□ E. serpens



△ E. biserrata
● E. gibbosa

Maps 1-3. Distribution of *Eremophila* species and sub-species.

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BIOGRAPHICAL NOTES ON ROBERTO BURLE MARX, A UNIQUE PERSONALITY.

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Abstract

Biographical notes are given on Roberto Burle Marx, the Brazilian landscape architect and artist. Some of his better known projects are enumerated and his use of Brazilian and other tropical plants in dramatic landscape design is discussed. It is demonstrated that plantsmanship and creativity based on abstract art forms combine with architecture and social need in the works of Burle Marx.

Biographical Notes

Son of a Portuguese Catholic mother and a German-Jewish father, Roberto Burle Marx was born in 1909 in Sâo Paulo and went to Rio de Janeiro with his family in 1913 as a young boy. His horticultural career began when he learned about plants from the women of his family. His mother loved flowers and his so-called "second mother", Ana, who lived with his family, grew all manner of vegetables. A cultured immigrant from Hungary, she taught Roberto to love plants and grow them. She remained in Roberto's home after the death of his parents, where he still cares for her with tender consideration at her great age of 102.

As a youngster of 15, Roberto sold his vegetables and used the proceeds to import plants from Europe, trying exotics like tulips and hyacinths, and learning what would thrive by trial and error. When he went to Europe in 1928 for 2 years, in order to study painting in Berlin, he discovered the magnificent flora of Brazil at the Botanic Garden, Dahlem. Returning to Rio in 1930, Roberto began his career as a painter in the National Academy of Fine Arts, Rio, studying under Leo Putz and Cândido Portinari, and continued with his hobby of gardening.

Projects

Some two years later, being rather pleased with a colour combination of foliage, he invited Lucia Costa, an architect and city planner who lived nearby and had known him since childhood, to come and see his garden. Impressed, Lucia Costa asked him to make a garden for a family called Schwartz in Rio, which he completed in 1932. He was then commissioned to plant a city square in Rio. His painting career flourished at the same time and he had an exhibition in Pernambuco, where he went in 1934, remaining there for about 3 years. He designed his first public garden in a square in Recife, as well as the water garden of Casa Forte and Bemfica cactus gardens. The Ministry of Education and Culture in Rio had originally been designed by the architect Le Corbusier, who supplied rough drafts which were then developed by Lucia Costa and a team of architects, including Oscar Niemeyer. Roberto Burle Marx was asked to design gardens at ground level and on the 2nd and 15th floors in 1936, which were his first public gardens in Rio. In 1937 he received the Gold Medal for painting from the National Academy of Fine Arts, and designed the garden for Sr Alberto Kronforth at Theresopolis, Rio, Fig. 1. The roof garden of the Brazilian Press Association in Rio was designed by Burle Marx in 1940, and the following year saw some of his paintings and drawings included in an exhibition of Brazilian art staged at the Royal Academy, Burlington House, London. The gardens of the Park of Pampulha, near Belo Horizonte, Minas Gerais were designed and executed by him in 1943, and the Park of Araxá in the same state was also designed by him in collaboration with the botanist Henrique Lahmeyer de Mello Barreto, who took him on many botanical excursions into the wilds. There he studied how plants live together in association in their natural surroundings, and increased his knowledge of the rich flora of Brazil. Only 19 of the 25 sections of the Araxá Park were ever completed.

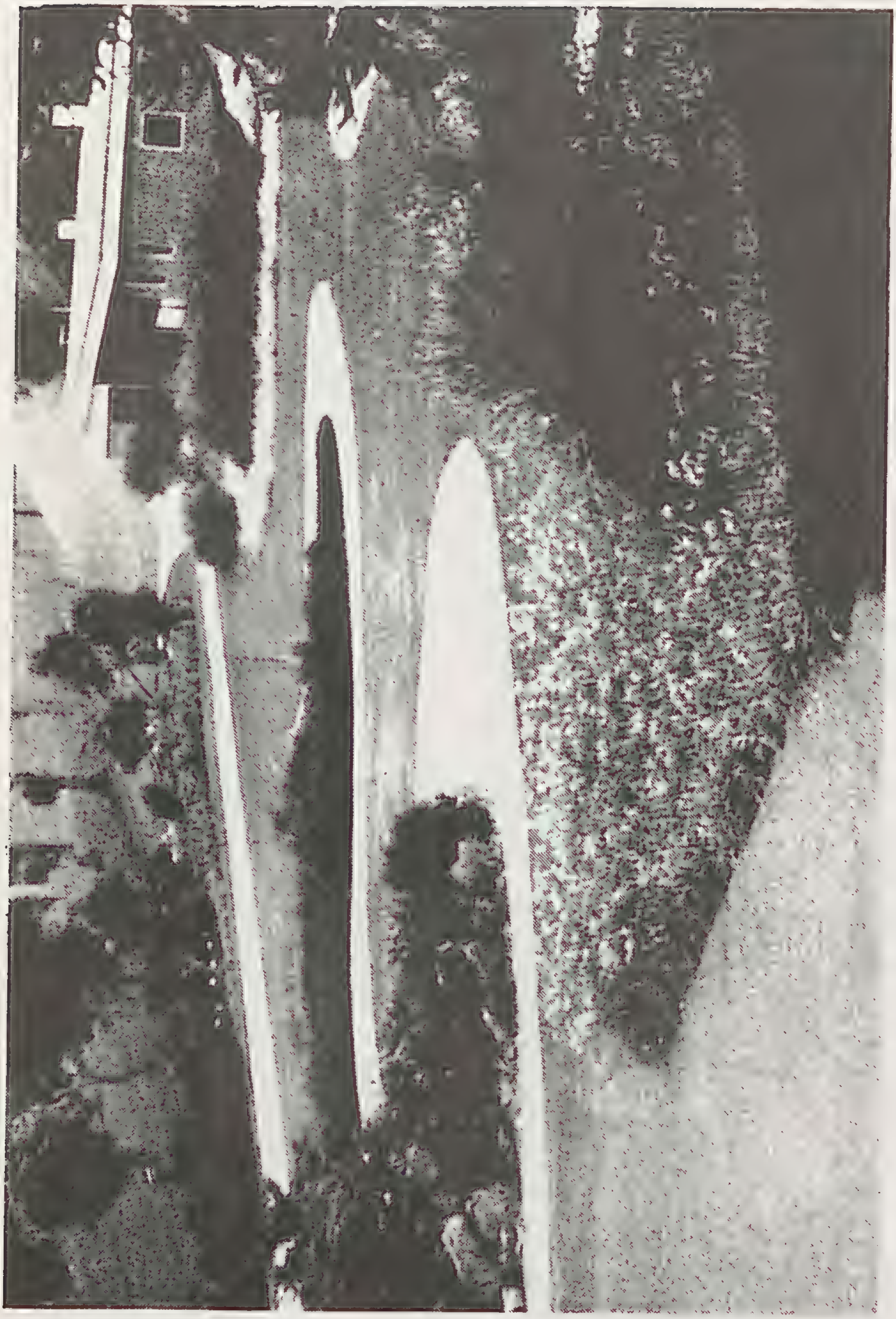

Fig. 1. The Kronforth Garden, *photograph courtesy of Verlag Gerd Hatje.*

Fig. 2. The Odette Monteiro Garden, *photograph courtesy of Verlag Gerd Hatje.*

In 1946 he staged an exhibition of his paintings in Sâo Paulo; in 1948 was exhibited in the Brazilian section of the Venice Biennial, and in 1952 had a retrospective exhibition of paintings and landscape designs in the Museum of Art, Sâo Paulo. His designs for the theatre in 1947 for 'As Aguas' in Rio, and in 1953, for Stravinsky's ballet 'Petrouchka' in Sâo Paulo, demonstrate his versatility.

In 1946 he also began the design of the Odette Monteiro Garden, Correia, Petrõpolis, the private garden he designed for Odette Monteiro. It features plants in bold groups making a strong statement in the immense landscape; a valley encircled with vast domes of black rock scattered with native bromeliads and bordered with indigenous trees. A huge flowing bed containing thousands of yellow "Day lilies" (*Hemerocallis*) leads from the house down the sloping lawns and directs the eye to the central lake he created in the bowl of the valley. Plants of botanical and horticultural interest border the lake, with stepping stones taking one across from one side to the other. Purple azaleas, crinums, striped ribbon grasses and purple *Iresine* grow in happy juxtaposition, with enough interest to whet the appetite of the plantsman, yet forming a tranquil picture to be enjoyed from the house. The simple pathway extending along the right hand hillside is drawn with the bold assurance and verve that only an artist could achieve and leads the eye into the distance, Fig. 2.

Between 1947, when he returned from a trip to Europe, and 1954 he designed a number of memorable private gardens in which his bold, fluid, massed plantings featured, gardens such as those of Sr Carlos Somló (1952) and Sr Alfredo Baumann (1953) of Itaipava, Rio State; Sr Cavanelas (1954), Pedra do Rio, Petrõpolis, Fig. 3; and Sr E. Waller (1954) of Rio. Between 1947 and 1951 he created a number of tile and mosaic garden walls, such as those of Sr O. Gomes (1951) of Sâo José dos Campos, but later in the decade, concrete decorated walls were made, such as that for Sr F. Pignatari (1956) of Sâo Paulo, some incorporating decorative water effects.

Burle Marx's large projects began in 1952 when he designed the gardens associated with Santos Dumont Airport as a first module in a series along the Bay of Rio; the Beira Mar project to be co-ordinated later in 1962. He completed the 'Botafogo' in 1954, the 'Aterro du Gloria' including the Museum of Modern Art and Monument of the Expeditionary Corps of World War II between 1956-61, and the 'Flamengo' in 1964. These comprise some of his best known works in the sixties. The black and white mosaic sidewalks he designed in 1970 along the "Avenida Atlantica', bordering the 'Copacabana Beach' in Rio, known as the 'Aterro de Copacabana' were meant to provide a changing pattern for the passing motorist and to relieve monotony by creating movement to the eye. Looking down on these designs from apartments above the street, one sees a flowing abstract design complementing the waves of the nearby sea. Plants are not forgotten, for there are groups of 4 or 5 palms punctuating the pavements, sometimes interplanted with other groups of trees that thrive by the sea, such as the tropical "Indian Almond" (*Terminalia catappa* L.) with its red summer foliage.

In 1953, he won the prize for landscape architecture at the 2nd International Exhibition of Architecture, which formed part of the Sâo Paulo Biennial festival, and in the same year produced designs for landscaping of Galeâo Airport on Governors Islands; the new campus of the University of Brazil in Guanabara Bay, and the gardens of the American Embassy in Rio.

He was appointed Professor of Landscape Design in the School of Architecture, University of Brazil in 1954, visited America and Cuba on a lecture tour, and opened his first American one-man exhibition at the galleries of the Pan-American Union, Washington. In the same year he designed the garden of the Jaquera Chapel, Recife, Pernambuco. The following year he visited Europe, sponsored by the Brazilian Ministry of Foreign Affairs on an invitation from the Institute of Contemporary Arts, holding an exhibition in London. Also in 1955 he designed the Guimarâes Gardens, Copacabana, Rio. The design for the roof garden of the Museum of Modern Art in Rio dates from 1956.

Fig. 3. The Cavanelas Garden, *photograph courtesy of Verlag Gerd Hatje.*

Burle Marx designed the gardens of the Brazilian pavilion at the Brussels International Exhibition of 1958. The design for the landscaping of the University of Brazil Faculty of Architecture, and its roof garden date from 1960.

Burle Marx's best known work in Venezuela started as early as 1954 when he designed the parkof the Hotel Pico de Avila, in Caracas. In 1958 he designed the garden of Sr Inocente Palacio in Caracas (Fig. 4) although, in the preceding year, his involvement with the Parque del Este in Caracas first started. This is a central park with concentrations of plants among the skyscrapers in the centre of the city and principally in roof gardens. The buildings are not yet finished, but the plans are done and the plantings will come later.

Roberto Burle Marx has worked with many famous architects while constructing his gardens, notably Oscar Niemeyer, Affonso Eduardo Reidy and Ruy Otaki. Since 1964 he has participated in the design of the Government Buildings in Brazilia through the magnificent gardens surrounding them — masterpieces of design, sculptural quality and structure, with interesting plant materials.

At the Palace of Justice in Brazilia, he uses giant, grey-leaved *Vriesia* in bold groups to contrast with flowing purple masses of the groundcover *Setcreasea.* Huge clumps of *Philodendron* shelter under shaded areas overhung by falling waters pouring over crescent-shaped concrete basins which scallop the facade of Niemeyer's building. Lesser plants would be overwhelmed by the massive architecture, but Burle Marx's philodendrons compliment it.

His rock forms grouped in the lakes outside the Ministry of War, 'Praca Triangular', represent the semi-precious stones of Brazil. They are sculptural groups in themselves, reminiscent of the elemental 15-stone garden at Ryoanji in Kyoto, Japan, but very much a creation of Burle Marx's own imagination, with a contrast of tranquil waters backed by tall palms and broken by stretches of water plants like the "Water Poppy", *Hydrocleys.*

The Winter Garden at the 'Itamaraty Palace' in Brazilia is a tropical indoor garden featuring plants from the Amazon, including the sculptural form of *Ceiba erianthos* K. Schum., with its beautiful thorny stems. Three of Burle Marx's tapestries hang in the Banquet Room of this 'Palacio dos Arcos'.

Important works by Roberto Burle Marx presently in progress include a pavilion, intended primarily for sporting activities, featuring flowers and plants, to be set in a large park in Brazilia. People will be able to walk through it and enjoy the flowers. He is also planning a Civic Centre in Curitiba, Parana, which is 900 m above sea-level and has a cold season, and a sea-front planting with mosaics and sub-tropical trees at Florianopolis in Santa Catarina.

He is taking part in a large team project to afforestate the zone of the badly polluted Tietê River in São Paulo. This will cover 600 hectares and be the largest green area in the city.

Style and materials

Roberto Burle Marx is a man of many talents, developed from an early age, partly by the circumstances of his life. His name conjures up an instant reaction among those who have seen or heard of his works in Brazil, which have become world famous. One could say, without fear of contradition, that he is one of the greatest living landscape architects of our time and has exerted more influence on the development of contemporary gardens than any other designer. Many landscape architects have produced great works in the past few decades, but Roberto Burle Marx is an innovator, exhibiting a rare combination of artist and plantsman, having an architectural understanding, yet never being so dominated by structures that he forgets his plants in their endless variety. At a time when landscape architects are apt to concentrate more on the architectural lay-out of a garden than on variety of plant material, when specialisation amongst nurserymen is leading to more limited choice of plants, when designers are apt to choose a handful of "easy-care" plants and weave

Fig. 4. The Palacio Garden, *photograph courtesy of Verlag Gerd Hatje.*

them into low-maintenance, often dull compositions, sometimes through lack of knowledge about the plants themselves, Burle Marx gardens shine like stars. They are filled with choice plant materials, arranged with drama, beauty and an understanding of artistic principles, using plants and inorganic materials, such as stones and water, that complement each other. There are also touches of fantasy in his gardens, helping to create an emotional effect which is his ultimate intention.

He uses plants and colour to convey moods and utilises those species which have architectural qualities. The large leaves of many Brazilian and other tropical plants provide him with ideal subjects. Plants with striking appearance always intrigue him and he uses them in order to accentuate character and emphasize structure in a garden.

His gardens are meant to create movement, with changing vistas at every turn, emphasized by flowing lines and colours. The movement of people is directed through the plants. Falling water is introduced into his gardens as often as possible, as much for its sound as for its movement.

Like an architect, Burle Marx does not design gardens in a two-dimensional manner. One cannot judge his gardens by looking at one of his plans, any more than a house may be judged by its floor plan. He sketches elevations and makes drawings that bring his designs to life. He first makes a rough draft, with many drawings and paintings so that the draftsmen and architects in his office may interpret his wishes and translate them into working plans. He chooses the plants, supervises each garden and exercises control over all the work. The two chief architects who work in collaboration with him are Jose Tabacow and Haruyosni Ono.

Burle Marx is deeply concerned about the preservation of nature in Brazil and is appalled at the destruction of plants that is taking place. People owning large tracts of land in the Amazon are indiscriminately destroying native plants in the name of agricultural development, and upsetting the eco-system. A glace at the hillsides around his home bears witness to the trend of destroying the natural vegetation in order to plant fruit of commercial value. Few native trees have been retained as far as the eye can see. He is always speaking to newspapers and appealing to the public to preserve the natural flora, but there are no comprehensive laws to implement these aims. No permits are required to collect plants. Anyone can go into the interior with a truck and collect as much as they like.

Roberto Burle Marx has collected specimens in the past and financed many expeditions himself, living in the forest and encountering hostile tribes. He knows of the difficulty of financing expeditions to collect wild plants. His collection is unique and he is deeply concerned about what will happen to it when he is no longer able to care for it. He is frequently asked to sell it but cannot bear the thought of its being broken up. His plant collections in his garden represent a National Treasure and funds should be made available to preserve it for the people of Brazil and the world.

His garden is like a botanical garden, with collections of plants from all over Brazil. He grows an extensive collection of *Philodendron* (over 430) and his name is commemorated in *P. burle-marxii* G.M. Barroso. He also owns a huge collection of *Heliconia* which are striking plants with dramatic flowers and foliage, and his name is commemorated in *H. burle-marxii* L. Em. Begonias, anthuriums, alocasias, orchids, bromeliads, ferns — all tropical plants with magnificent foliage and flowers have a place in Burle Marx's collections, not to mention the splendid flowering trees and palms from other climatic zones of the world.

People continually make the pilgrimage to his *sitio*, a farm of 142 hectares, situated about 60 km from Rio, in order to visit his nursery and garden. He has a remarkable lath house, covering several hectares, which contains many rare and beautiful plants. Visitors have to be restricted or his nursery would be overrun. Landscape architects, architects and botanists are equally welcome guests and he likes nothing better than to see a circle of

friends, young and old, around his dining table on a Sunday to share with them the delights of his garden. He loves people about him, seeking out those with similar interests and appreciation. He believes that curiosity about flowers, birds, nature and beautiful things forms the basis of life and makes it fascinating.

The plant-lover who takes a walk around the grounds may suddenly find chandeliers of delicate scarlet blooms hanging from *Amherstia nobilis* Wall., or white or pink waxy *Clusia* blossoms festooning these large evergreen trees from the Amazon, blooming in early summer. Their rounded buds above the foliage give them the common name of Onion-of-the-Forest. The Rose of Venezuela, *Brownea,* thrives in his garden, and the pale pink canopy of *Cassia grandis* L. rises high above the garden in early summer and may be seen from afar. *Victoria amazonica* (Poeppig) Sowerby spreads over a new lake in the garden, but Roberto does not forget to show me, in a corner, a fairly rare Water Crinum *C. campanulatum* Herb., from South Africa, that I sent him.

Striking plants move him to compose arrangements in the garden in order to reveal their maximum beauty. He will place a giant rosette of *Aechmea,* with smooth, tawny leaves, beside the grey, spiky curled spiral foliage of the South African *Encephalartos horridus* (Jacq.) Lehm. His desire to display the exotic, pendent green sprays of the Jade Vine, *Strongylodon macrobotrys* A. Gray inspired him to design a special courtyard as a suitable setting. A high concrete trellis overhead, that throws a pattern of slanting shadows on to a paved floor, encloses a tranquil pool that will reflect the colour of the Jade Vine above it. This pool is bordered by beds carpeted with small decorative bromeliads such as *Cryptanthus zonatus* (Vis.) Beer. Fish will move in the water and feeding trays hung for hummingbirds will bring life to the scene. Only by knowing the characteristics of this climber and using his artistic skill could he picture how the strange turquoise flowers in their thousands will sway in the slightest breeze dropping into the water and onto the paving, to form a memorable spectacle for the onlookers. He has planned the viewing area on a verandah overlooking the courtyard, where one may sit and enjoy the scene. Massive ledges constructed from old stonework rescued from demolished buildings, hold water and can be fed from three spouts so that they produce the sight and sound of running water at the turn of a tap. The high supporting wall of a pergola is festooned with staghorn ferns hung on wooden frames, and may be watered from the top by means of trickle irrigation through a clever arrangement of thin pipes, the water percolating through each layer of plants as it might do in a dripping forest. The back of the courtyard is open to a background of trees in the garden, affording a view of the trunk on an immense Fig Tree (*Ficus*), with giant bromeliads, *Vriesia imperialis* Morr. ex Baker strategically balanced near the base.

Burle Marx has a sense of fun and fantasy, demonstrated by papier maché sculptural forms placed on the paving of a courtyard. These are in the shape of a series of columns, of varying heights and widths, painted in black and white to compliment the white tiled floor and the striped shadows from the roof. Later, he explained, he would remove them. He felt that there is nothing wrong with having sculptures made of papier maché if one could protect them from the rain, or in being able to move sculptures around whenever one felt like it. Change is what makes a garden dynamic and interesting, varying in appearance from time to time.

His home is a reflection of his artistry and his fascination with Brazil, containing collections of native artifacts as well as natural objects of beauty. He has collections of Brazilian ceramics set into glass-fronted recesses in the walls of his living rooms and passages, each arranged in harmonious groups. There is very old pottery in one recess; modern glass in another; figures from old churches in yet another. Primitive beige and orange clay pots in the form of figures and animals from La Vallée du Jequitinhonha stand on wide shelves. Massive wooden entrance doors, taken from an old church, will be restored and painted to match the other woodwork in traditional Portuguese style. One of his huge paintings dominates a massive sideboard, made from an old altar, featuring a collection of antique crystal sugar bowls.

Fig. 5. Roberto Burle Marx, *photograph by Sima Eliovson.*

Lavish flower arrangements decorate the house. A huge bowl of flowers in season dominates the dining-room. During winter this consists mainly of red *Bixa* fruits and pale green massed seedheads of *Kalanchoë,* while, in the summer, the more exotic pink torch-lilies or scarlet heliconias will be featured. Pillars of dried material frame the doorway leading to a music room, composed of masses of brown raffia seeds, clusters of brilliant red *Bixa* fruits, golden puffs of dried flowers of *Stifftia,* with dried rosettes of small *Tillandsia* and the papery seed-heads of *Blighia.* Tall pedestals in the corners of an outdoor room feature long fronds of ferns trailing to the floor, *(Polypodium subauriculatum* Bl.).

The rear entrance to the house is flanked by a group of beautiful specimens of *Nolina recurvata* (Lem.) Hemsl. a tall Mexican plant of strikingly graceful form and character. Large rounded river-stones lie in groups in simple, rectangular beds alongside the flagstone paths, bordered by several kinds of bromeliad and philodendron, dominated by an immense, spreading Red Silk Cotton Tree (*Bombax ceiba* L.), always a subject of interest with its red flowers and bronze new leaves.

It is impossible to think of Roberto Burle Marx (Fig. 5) without thinking of exuberant flowers and dramatic foliage. He is surrounded by them on all sides and has made them part of his environment. No one but he has used the glorious flora of Brazil to such effect, and although he uses Brazilian flora he also enjoys using beautiful plants from all over the world. He is an artist, whose paintings and drawings hang in many art galleries and public buildings in Brazil and Europe. Many of his paintings and tapestries seem to be inspired by the magnificent tropical foliage of Brazil; they seem to invoke the atmosphere of the forest, revealing stark bands of light on huge leaves, reflecting brilliant blues and greens from the shadows, conveying abstract forms of trunks, twisted lianes and other living shapes in their

composition. He is always seeking to improve the quality of his own thoughts and surroundings. His philosophy permeates his work and he quotes Le Corbusier, who said that one needs to be surrounded by objects of poetic emotion. His collection of ceramics and other art objects, his floral composition in his house, all bear witness to this desire which is part of his personality.

Virtually a legendary figure in his own lifteime, Roberto Burle Marx combines all the attributes of a man of great talent with those of a man of great warmth. He is sensitive to the feelings of others, unprejudiced and judging people only as to whether they are good. He is generous to a fault, full of imagination and humour and sometimes mischievously ironic. Above all he is always thinking of the people who will live, move and relax in his gardens; fighting for the preservation of plants in nature, educating people to enjoy a greater quality of life through plants, thrilled at the discovery of a new plant or flower above commercial considerations. Despite his prominence in a double career of artist and landscape architect, he lives in a simple manner. Financial success is used to maintain his large staff and garden. Whenever he can he develops new ideas in his garden, always seeking to create new beauties. Whatever his setbacks may be, he rises, ebullient as ever, to the challenge of the moment. He needs the stimulation of his friends, while they, in turn, are stimulated by him and his love of life.

J. Adelaide Bot. Gard. 1(4): 275-276 (1979)

FLORA OF CYPRUS — A REVIEW OF VOLUME 1

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While engaged on a summer studentship in the Kew herbarium in the early 1960's, I was assigned to Mr R.D. Meikle and charmed by his easy botanical knowledge and anecdote shared equally over a herbarium specimen, or cup of tea on the back steps of the herbarium before the new wing was built. It was at that time I associated his name with the flora of Cyprus, so that publication in 1977 of volume 1 of a *Flora* is especially significant for me.

With the near completion of *Flora Europaea*, and the *Flora of Turkey*, Meikle's volume helps provide a long overdue coverage of a large and floristically complex area north and east of the Mediterranean Sea. *Flora Europaea* includes Crete in its coverage but not Cyprus. In style, Meikle's *Flora* is nearer to that used in *Flora of Turkey*, being more detailed than *Flora Europaea.*

The book measures 24 x 15 cm, contains 832 pages with a coloured frontispiece showing *Onobrychis venosa* (Desf.) Desv., and also 52 line drawings by artists such as Margaret Stones, Mary Grierson, L.M. Ripley, and D. Erasmus. It is a pity that 27 of these drawings were culled from *Flora of Iraq*, and that originals could not have been commissioned for *Flora of Cyprus.* A selection of this size must surely be primarily for decoration and not as an aid to the user. The paper is a little thin and 'ghosting' of print occurs, but in a volume of this size (the book is 4.5 cm thick), is perhaps a necessary evil. Space has been saved by omitting a glossary, but has been wasted in the tabular presentation of specimen citations (where are these specimens housed?). These citations could have been run on with only partial loss of clarity. The lack of a glossary, citation of specimens and citation of the type of the name recognized by Meikle for each taxon described, all suggest that the work is intended primarily for the professional rather than the informed layman or weekend botanist.

Published by the Bentham-Moxon Trust and printed by Robert MacLehose and Co. Ltd, the text is clearly set out and printed, the cloth bound boards substantial, but the spine will probably soon require repair with regular use. The gold blocking of the spine and front board is restrained and attractive.

After a preface by Prof. J.P.M. Brenan in which the importance of the descriptive flora is reaffirmed, and in which the anticipated completion of the *Flora* in a second volume is mentioned, Meikle briefly comments on the topography, climate, botanical divisions and history of botanical exploration of the island. This last section contains itineraries of Sibthorp, Kotschy, Holmboe and others. The treatment restricts itself to gymnosperms, angiosperms and ferns, and families are arranged according to the Bentham and Hooker system.

The names of native or naturalized species are denoted in bold type which might have been better in 10 point instead of 8 point; introduced (but presumably not fully naturalized) taxa, escapes and a selection of cultivated species by small capitals and synonyms by italics. The value of this distinction is marred by apparent inconsistencies; the naturalized *Cistus ladanifer* L. is in bold, but naturalized *Opuntia ficus-indica* (L.) Mill. in small capitals. Similarly, *Liquidambar* is said to be cultivated but is cited in bold typeface.

Habitat data are derived chiefly from herbarium labels, and distribution data outside Cyprus are intended only as a rough guide. It is pleasing to find that garden plants have found a small place in the *Flora* and one recalls Meikle's delightful "Garden Flowers" published in 1963 by Eyre and Spottiswoode, London. Of Australian interest is the inclusion of eight *Eucalyptus* and ten *Acacia* species. It is curious that *Pelargonium* is not apparently present in Cyprus gardens or ever escapes.

The taxonomy is well done but a key to families has been postponed until publication of volume 2. Family descriptions are short and functional, as are generic keys and descriptions. The species keys appear to work well, and species descriptions comprehensive, sometimes being quite long. The citations to the literature of taxa are informative. The Cucurbitaceae is written by C. Jeffrey and Guttiferae by N.K.B. Robson. In anticipation of review Meikle summarizes the modest quota of new nomenclature of volume 1 in his Appendix III; there are 4 new varieties and 17 new combinations. Appendix I is a list of pertinent literature cited in the work, and Appendix II is a list of collectors and collection dates. Families 1-50 (Pinaceae-Theligonaceae) are dealt with in volume 1. The notes on certain taxa are interesting, such as in *Paliurus spina-christi* Mill. and *Pistacia* spp.

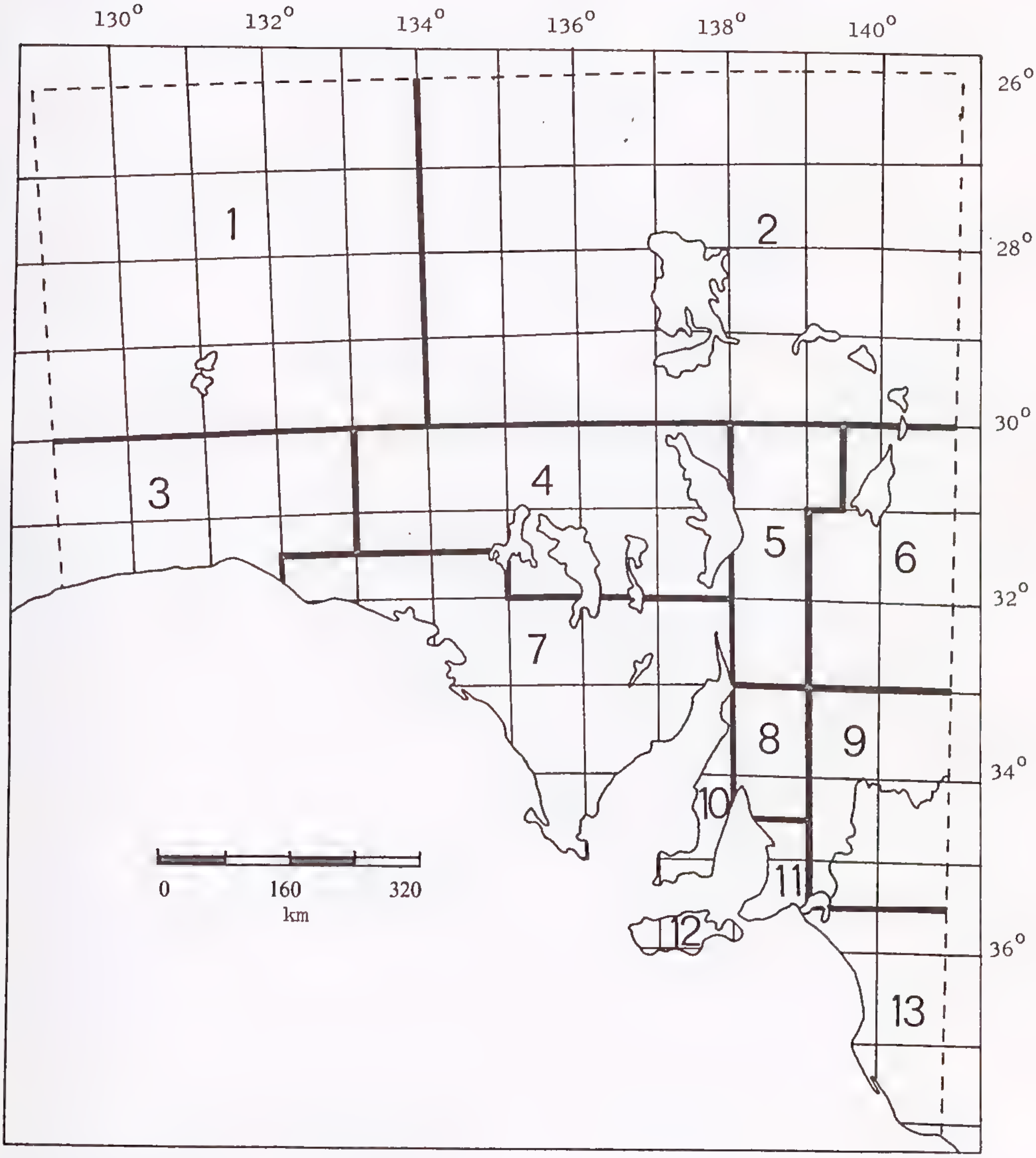
Proof reading appears to have been well done but minor inconsistencies in author citation of plant names occur: Medik/Medik., Adanson/Adans. The varieties of *Anemone coronaria* L. are given in italic in the text but roman typeface in the index; Meikle states in the text that these infraspecific categories have doubtful meaning. There is also a poetic misspelling of *Bryonia* in the index; *Byronia* is a generic synonym for *Ilex* L.

At £20.00 per copy the *Flora of Cyprus* is not cheap, but the Bentham-Moxon Trust at Kew, to which orders should be sent, will be assured of sales to instutions and serious students of the flora of the region, such is the utility of the work, Mr Meikle and the Trust are to be congratulated. Perhaps a request might now be made for a slim synoptic flora in English, Greek and Turkish, appropriate for fieldwork and tourist use.

Meikle, R.D. *Flora of Cyprus*, Volume One, pp. 832, one coloured frontispiece, 52 line drawings, 3 appendices, index. Bentham-Moxon Trust: London, 1977. Price £20.00, plus postage (U.K. and overseas surface 90p. per copy).

REGIONS OF SOUTH AUSTRALIA ADOPTED BY THE STATE HERBARIUM — ADELAIDE

1. North-western
2. Lake Eyre Basin
3. Nullarbor
4. Gairdner-Torrens Basin
5. Flinders Ranges
6. Eastern
7. Eyre Peninsula
8. Northern Lofty
9. Murray
10. Yorke Peninsula
11. Southern Lofty
12. Kangaroo Island
13. South-eastern



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Printed by PRINT MINT

JOURNAL of the ADELAIDE BOTANIC GARDENS

CONTENTS

JOURNAL of the ADELAIDE BOTANIC GARDENS

Volume 1 Part 5

25 June, 1979

Instructions to Authors

Topics

Papers will be accepted in the following categories:

(a) Plant systematics (Australian and horticultural groups); (b) Descriptive plant morphology, anatomy and ecology; (c) Obituaries, biography and history; (d) Bibliographic studies, book reviews; (e) Botanical illustrations; (f) Noteworthy horticultural contributions.

Copy

Manuscripts must be typed, with double spacing and margins at least 3 cm wide, on one side of the paper only. Three copies must be submitted. Captions must not be italicized, underlined or typed in capitals. All scientific names of generic or lower rank must be underlined.

The print area for illustrations is 20 x 13 cm (including captions). Half-tone material should be submitted this size if possible, but will be reduced by the printers, if necessary.

Reprints

25 copies of reprints will be provided for each paper. Additional reprints may be purchased at cost

Layout

The pattern of the paper should generally be:

(i) Title; (ii) Author and Address; (iii) Abstract (except for short papers); (iv) Introduction and subject matter; (v) Acknowledgements; (vi) References.

References

Text references to publications should be indicated as follows: (Smith, 1959), (Smith, 1959, p. 127), Smith (1959) or Smith (1959, pp. 125-208). The final section of the paper, headed 'References', should include only those titles referred to in this way. It should be laid out as follows:

Smith, K. L. (1879). The species of *Danthonia* found in pastures in Victoria. *Austral. J. Bot.* 65: 28-53.

Bentham, G. (1868). "Flora Australiensis", Vol. 4. (London: L. Reeve.)

Baker, J. G. (1898). Liliaceae. In Thiselton-Dyer, W. T. (ed.), "Flora of Tropical Africa", Vol. 7 (Ashford: L. Reeve).

Journal abbreviations must be consistent within a paper and authors are recommended to follow "Botanico-Periodicum-Huntianum". Journals not cited in B-P-H should be abbreviated to conform with this general pattern. The following abbreviations for Australian states should be used: WA, NT, SA, Qld, NSW, ACT, Vic., Tas.

Text references to specimens should be italicized, for example *Koch 276*.

Indices

When required, follow the pattern on, for example, p. 106 of vol. 1, pt. 2.

Recommendations on taxonomic papers

Synonymy

Authors are requested to include in the synonymy only references to publications containing information additional to that to be published in the paper being submitted. Within this section journal and book titles must be consistently abbreviated. B-P-H journal abbreviations and book titles abbreviated in a similar way are desirable. Authors of references cited in the synonymy should be abbreviated.

References may be cited as:

Benth., *Fl. Austral.* 4: 111 (1868) OR
Benth., *Fl. Austral.* 4 (1868) 111.

Citation of specimens

10-30 specimens should be cited for each species (or subspecific taxon), although this may be varied under certain circumstances. The author may decide whether or not to include dates of collections and the sequence, provided a constant pattern is adhered to throughout a paper.

Authors wishing to cite all specimens seen may list them all in an index to collectors after the style of the "Flora Malesiana" identification lists. Collections not identifiable by a collection number (assigned by either the collector or herbarium) should cite dates.

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J. Adelaide Bot. Gard. 1(5) (1979) : 277-279

JOHN CARRICK, B.Sc. (Hons.), F.L.S.

On 14th June, 1914, John Carrick was born in Glasgow, Scotland, the youngest of three sons of John and Isabella. His Bachelor of Science (with First Class Honours in Botany) was awarded by Glasgow University in 1938, the year before the outbreak of the War. Until 1940, John undertook post-graduate research in Mycology, but then joined up and between 1940 and 1946 saw service as a Radar Officer in Britain, India, and Burma. This period not only provided an introduction to the Asian continent in which he was later to spend many profitable years, but also kindled an interest in the spiritual life of some of the peoples — he retained an interest in Tibetan Buddhists throughout his life.

In 1941, John married Nan Galbraith. When they went to Singapore in 1952, she contacted polio and could no longer walk unaided. For 25 years John devoted himself to giving Nan the best in life that was possible with this limitation.

After the war, he went for five years to the University of Manitoba, where he lectured principally in Mycology and Plant Pathology. From 1952 to 1967 John again lived in Asia, occupying several posts; as Lecturer, principally in Plant Physiology at the University of Malaya (Singapore), 1952-59; Senior Lecturer in Botany at the University of Malaya (Kuala Lumpur), where his research interest was centred on soils and origin of Kerangas (heath forest) vegetation in Sarawak and including a period as Head of the Department (1959-65); and as Colombo Plan Field Pharmacognocist attached to the University of Malaya (Kuala Lumpur), working on an organic phytochemistry survey of Malaya and training local personnel, 1965-67. While still in Singapore, John was involved in the planning of the Botany Department in Kuala Lumpur and transferred to the new Department when the first class was being taught in temporary accommodation. He played a significant part in designing courses and recruiting staff. Duncan Poore, a colleague of John's, at that time, writes that "His thoroughness and good humour made him an invaluable member of the Department and his cheerfulness, patience and humanity made him a friend of all the students who came in contact with him".

Another colleague of the Malaysian period was Kwiton Jong, whose memories of John echo those of Dr Poore; his sense of humour, the enthusiasm and love of botany with which he infused his students and, he adds, "his facility in the Malay language which also endeared him to the local people".

In 1968, John took up a post as Botanist at the State Herbarium of South Australia. While routine responsibilities took up the major part of his time, including spells when he acted as Head of the Herbarium, he did also participate in floristic surveys, the largest of these being the survey of the site of a proposed town at Monarto, and in taxonomic research. While a revision of the Prostantheroideae (Labiatae) was his principal research interest, he did find time to describe a new species of *Grevillea* (Proteaceae) and to complete a large part of the review of the South Australian species of *Melaleuca* (Myrtaceae) accompanying this account of his life. The revision of the Prostantheroideae produced two papers, each on a minor genus, one of which was new to science, but had not advanced sufficiently far for his notes to yield any further publications.

In 1970/71, John was Australian Botanical Liaison Officer at Kew, and in 1972 was elected to Council of the Royal Society of South Australia, serving as Programme Secretary until 1974.

During the last couple of years of his life, John suffered increasingly frequent spells of ill health, but, when his death came on 4th January, 1978, it was totally unexpected. He is survived by his wife, Nan, daughter, Anne, and son, Ian.

John Carrick, B.Sc.(Hons), F.L.S.

His character, as it will be remembered by his colleagues in Australia, was well summed up in an obituary in the 'Newsletter of the Australian Systematic Botany Society', "John's advice was frequently sought and freely given on many botanical problems, especially with Latin translations and as the Herbarium authority to whom to turn for a ruling on English. He was quiet and reserved, very loyal to his family, friends and colleagues, and had a ready sense of humour based much on puns and plays on words. The literary side of his interests was not widely appreciated; he was not only fond of poetry, particularly that of Burns and Shelley, but was no mean poet himself".

John was a scholar, proficient in the use of English and botanical Latin, and interested in literature, music and the theatre. He wrote a number of poems, of which this tribute to his English schoolmaster is now sadly appropriate for John himself:

In Memoriam, D.A. — 14 February 1938

Our birth, a mighty flush of red and gold,
Dawns through time's chaos and eternity;
Our noon, in an unfathomed brilliancy,
Shapes youth's keen courage in a sterner mould;
Our eventide, whose lingering shadows fold
In softer radiance and mystery
Our night, moves swiftly out o'er life's broad sea
When the lone evening star shines clear and cold.
Why do we weep? There is no sting in death.
His thoughts live on though he has passed away.

His memory, embalmed in heaven's breath,
Chides our dull sorrow — he would have us gay.

Ths storms within our wounded hearts subside.
We recollect his love for us — with pride.

Publications

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3. 1968. A further note on *Piper aduncum* L. *The Malayan Nature Journal* 21(1): 63-64.
4. 1968. Two Malayan botanical contacts with Siam. *The Malayan Nature Journal* 21(2): 100-103.
5. 1976. *Grevillea parallelinervis* (Proteaceae), a new species from South Australia. *Contr. Herb. Austral.* 15: 1-7.
6. 1976. Studies in Australian Lamiaceae. 1. The genus *Wrixonia* F. Muell. (Prostantheroideae). *J. Adelaide Bot. Gard.* 1: 27-34.
7. 1977. Studies in Australian Lamiaceae. 2. *Eichlerago,* a new genus allied to *Prostanthera. J. Adelaide Bot. Gard.* 1: 115-122.
8. 1979. (With Chorney, K.) A review of *Melaleuca* (Myrtaceae) in South Australia. *J. Adelaide Bot. Gard.* 1: 281-319.

J. Adelaide Bot. Gard. 1(5) (1979) : 281-319

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A REVIEW OF *MELALEUCA* L. (MYRTACEAE) IN SOUTH AUSTRALIA

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Abstract

Twenty-one species of *Melaleuca* (Myrtaceae) are recognised in South Australia. Separate keys based on floral and vegetative characters are provided and each species is described and synonymy, distribution maps and line illustrations provided. The following changes to the South Australian species, as treated by Black and Eichler in the "Flora of South Australia" are incorporated. Two endemic species, *M. nanophylla* sp. nov. (North-western region) and *M. oxyphylla* sp. nov. (Eyre Peninsula region), are described. *M. linophylla* F. Muell. is treated as endemic to Western Australia and material previously referred to that species placed under *M. dissitiflora* F. Muell. Willis, "Handbook to plants in Victoria", vol. 2, 1972, is followed in treating *M. oraria* J.M. Black as a synonym of *M. neglecta* Ewart & Wood.

MELALEUCA L.

(Greek *melas*, black; *leukon*, white; so-called from the black trunk and white branches of some Asiatic form of *M. leucadendron* L.)

Shrubs or small trees; leaves opposite or scattered, entire, flat, concave, or terete, or rarely with recurved margins, nerves 1-7 or obscure; flowers white, yellowish or purplish-red, closely sessile, each subtended by a small caducous bract, 1-3 in the axil of each leaf and scattered or in a more or less close spike, or in terminal or lateral heads, the axis often growing out before or after flowering, bracteoles very small and deciduous or absent.

Calyx tube hollow, campanulate, adnate to the ovary at the base, the free part erect or scarcely dilated, lobes 5, herbaceous, or scarious and more or less confluent, deciduous or semi-persistent. *Petals* 5, orbicular, concave, spreading, usually with a short claw. *Stamens* numerous, longer than the petals and arranged in 5 bundles opposite them, the filaments in their lower parts united in a long or short, broad or narrow, usually flat column, in their upper parts free, filiform, arranged along the margin, clustered at the apex or also arising from the inner face of the column; anthers versatile, cells parallel, dehiscence longitudinal. *Ovary* enclosed in the calyx tube, inferior or semi-inferior, summit convex and villous, with a central depression round the style, 3-celled, ovules usually numerous on a peltate placenta.

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*This paper was prepared as a precursor to the treatment in the third edition of J.M. Black's 'Flora of South Australia'. When the senior author died in January 1978 most of the descriptions had been prepared by him, including the Latin descriptions for the new species, and he had apparently finalized his concepts and the nomenclature except in the cases of subspecific taxa in *M. gibbosa* and *M. pauperiflora*. Mr Chorney did most of the preliminary sorting, checked identifications, made most of the detailed measurements on which the descriptions were based and prepared lists of specimens and distribution maps. Mr Dutkiewicz had completed the illustrations.

The only key was an almost completed vegetative key. Mr Chorney and I have since prepared the remaining descriptions (*M. gibbosa, M. glomerata, M. pauperiflora, M. squamea, M. squarrosa* and *M. uncinata*), drawing heavily on published sources, and prepared a second key. Except for these major items, all notes added since Mr Carrick's death are indicated by the use of square brackets.

In the lists of specimens examined all specimens cited are in AD unless otherwise indicated.

Types have in general not been examined, but those seen are indicated by reference to the herbaria to which they belong.

J.P. Jessop

Style filiform, stigma peltate, capitate or very small. *Fruit* small, sessile, sometimes embedded in the thickened stem; capsule enclosed in the enlarged woody calyx tube, opening loculicidally at the summit in three valves; perfect seeds few.

Over 100 species, almost entirely Australian, 21 in South Australia.

Key to the species (based on fertile material)

1. Leaves opposite ... 2
   Leaves alternate (sometimes sub-opposite or almost ternate) ... 12
2. Filaments red, pink or purple ... 3
   Filaments white, whitish or pale yellow ... 5
3. Staminal claw less than 2 mm long (much shorter than petals); fruiting rachis thickened ... 4
   Staminal claw more than 4 mm long (much longer than petals); fruiting rachis not thickened ... *M. wilsonii* 21
4. Leaves linear to oblanceolate, the apex straight or slightly incurved, obscurely veined, 5-15 mm long ... *M. decussata* 5
   Leaves ovate to obovate, the apex often recurved, distinctly 3-veined, 2-6 mm long ... *M. gibbosa* 7
5. Leaves sessile ... 6
   Leaves distinctly (but often shortly) petiolate ... 8
6. Fruits closely compacted; leaves attached by a dorsal areole near the base (not recorded from N.W. or Lake Eyre regions) ... *M. adnata* 2
   Fruits clearly separated; leaves attached basally (only known from N.W. and Lake Eyre regions) ... 7
7. Leaf flat; fruit about 3 mm diameter ... *M. linariifolia* 12
   Leaf strongly revolute; fruit 9-10 mm diameter ... *M. corrugata* 4
8. Leaves distinctly 5-7-nerved, ovate to ovate-lanceolate ... *M. squarrosa* 19
   Leaves 1-3-nerved or veins obscure, linear to ovate-lanceolate ... 9
9. Leaf margins strongly incurved; fruits 9-10 mm diameter ... *M. corrugata* 4
   Leaf margins flat, concave above, or moderately recurved; fruits 3.5-4 mm diameter ... 10
10. Staminal claw about 4-5 mm long; leaves less than 3 times as long as broad ... *M. acuminata* 1
    Staminal claw about 1.5-3 mm long; leaves more than 3 times as long as broad ... 11
11. Staminal claw about 2-3 mm long, filaments yellowish; fruits almost spherical; leaves flat or very shallowly biconcave ... *M. oxyphylla* 15
    Staminal claw about 1.5 mm long, filaments whitish; fruits more or less cylindrical; leaves strongly convex below ... *M. halmaturorum* 9
12. Leaves mostly less than 1 cm long ... 13
    Leaves mostly more than 1 cm long ... 19
13. Filaments purple or pink ... *M. squamea* 18
    Filaments white to yellow ... 14
14. Leaves less than 1.5 mm long ... *M. nanophylla* 13
    Leaves 4-15 mm long ... 15
15. Fruits 2.5-3 mm across; leaves sessile ... *M. bracteata* 3
    Fruits 4-8 mm across; leaves petiolate ... 16
16. Stamens yellow; leaves pungent ... *M. leiocarpa* 11
    Stamens white to pale cream; leaves not pungent (small hardened tip or mucro may be present) ... 17
17. Fruit rough; leaves with two rows of prominent glands below ... *M. neglecta* 14
    Fruit more or less smooth; leaves apparently without glands ... 18
18. Leaves more or less flat, lanceolate; flowers in loose spikes; fruit wall hard, aperture partly constricted ... *M. lanceolata* 10
    Leaves subterete to terete, linear; flowers in heads; fruit wall thin, aperture usually not constricted ... *M. pauperiflora* 16
19. Leaves terete or plano-convex with a fine usually curved point ... 20
    Leaves flat, more or less linear, acute, sometimes with a short hard tip ... 21

20. Leaves terete, almost sessile; staminal claws each with 4-7 filaments .... *M. uncinata* 20
Leaves plano-convex, distinctly petiolate; staminal claws each with 15-20 filaments . *M. rhaphiophylla* 17

21. Fruiting clusters dense, globular; leaves hairy when young .... *M. glomerata* 8
Fruit in loose elongate spikes; leaves glabrous .... *M. dissitiflora* 6

Key to the species (based on vegetative material)

This key is by way of an experiment. The senior author was often confronted with problems in identification of specimens because of the absence of flowers or fruits or both, and the idea of a key based only on vegetative characters (in this case only on the leaves), although not new, was one which was compellingly attractive. Acquaintance, though slight, with species of *Melaleuca* from other States, particularly Western Australia, emphasized the problems to be encountered in producing such a key for a wider area, but within South Australia it is certain that this can work. The authors can name a plant from a single leaf, but this is due to intimate acquaintance, which is not an easy thing to put on paper in a key. There are, of course, problem areas and two basic conclusions must be stated: (1) if only vegetative material is available, the South Australian species of *Melaleuca* can be identified; (2) if flowers or fruit or both are available, identification is more rapid and more certain.

Many leaves, particularly in dried specimens, are young. Measurements given are based on mature leaves but even in these there is still a fairly wide range in size which may be due in some cases to differences in ecological factors of the habitat. Therefore, where a certain limit has been set to segregate species into two groups, measurements have been qualified by "mostly".

1. Leaves opposite 2
Leaves alternate (sometimes sub-opposite or almost in whorls of 3) 11

2. Leaves sessile or almost so 3
Leaves distinctly petiolate 7

3. Leaves ovate to obovate .... *M. gibbosa* 7
Leaves linear-lanceolate or linear-oblanceolate 4

4. Leaf attached dorsally to the stem, the leaf-tip recurved .... *M. adnata* 2
Leaf attached basally to the stem, the leaf-tip straight 5

5. Leaf 15-25 mm long .... *M. linariifolia* 12
Leaf 5-15 mm long 6

6. Leaves linear-lanceolate .... *M. wilsonii* 21
Leaves linear to oblanceolate .... *M. decussata* 5

7. Leaves not 3 times as long as broad 8
Leaves at least 3 times as long as broad 9

8. Leaves 1-3-veined (often obscurely) .... *M. acuminata* 1
Leaves distinctly 5-7-veined .... *M. squarrosa* 19

9. Leaves flat or thick and shallowly concave 10
Leaves thin, concave; margins incurved .... *M. corrugata* 4

10 Leaves flat or very shallowly biconcave .... *M. oxyphylla* 15
Leaves strongly convex on the lower surface .... *M. halmaturorum* 9

11. Leaves mostly less than 1 cm long 12
Leaves mostly more than 1 cm long 18

12. Leaves sessile 13
Leaves petiolate, even if only shortly so 14

13. Leaves 4-10 mm long .... *M. bracteata* 3
Leaves less than 1.5 mm long .... *M. nanophylla* 13

14. Leaves pungent .... *M. leiocarpa* 11
Leaves not pungent (small hardened tip or uncinate mucro may be present) 15

15 Leaves distinctly 3-veined .... *M. squamea* 18
Leaves without obvious veins 16

16. Leaves with prominent glands on lower surface .... *M. neglecta* 14
Leaf surfaces more or less smooth, without apparent glands 17

17. Leaves lanceolate, more or less flat, apex acute and often recurved .... *M. lanceolata* 10
Leaves subterete or more or less compressed and thick, often with a very small mucro .... *M. pauperiflora* 16

18. Leaves terete or plano-convex with a fine usually curved point 19
Leaves flat, more or less linear, acute, sometimes with a short hard tip 20

19. Leaves terete, almost sessile, young leaves with appressed silky hairs .... *M. uncinata* 20
Leaves plano-convex, distinctly petiolate, young leaves glabrous .... *M. rhaphiophylla* 17

20. Leaves hairy when young, becoming almost glabrous, narrowly oblanceolate, with a very short hard point .... *M. glomerata* 8
Leaves glabrous when young, narrowly linear-lanceolate .... *M. dissitiflora* 6

1. **Melaleuca acuminata** F. Muell., Fragm. 1(1858)15; Fragm.2(1861)178; Fragm. 5(1866)209; Benth., Fl.Austral.3(1867)132; Black, Fl.S. Austral.ed.1(1926)407; ed.2(1952)607; Blackall & Grieve, West. Austral.Wildfl.1(1954)297, in clave; Willis, Handb.Pl.Vict.2(1972)453.

[*Type:* "In montibus lapidosis ad rivum Mount Barker Creek (South Australia). L. Fischer."]

Glabrous shrub, 1-2 m high, bark rough, ashy, branches slender, virgate. Leaves decussate, lanceolate to ovate-lanceolate, acuminate, acute, sometimes with a very short callus point, spreading, more or less recurved and often slightly twisted towards the apex, 5-10 mm long, 2-4 mm broad, 3-veined, sometimes obscurely so, smooth above, punctate-glandular below, petiole decurrent, about 1 mm. Flowers on the previous year's branchlets in lateral clusters of 3-6; calyx tube about 2 mm long, glabrous, lobes more or less deltoid, about 1 mm long and broad, persistent; petals white or tinged with pink, almost circular, about 2 mm diameter; staminal claws about 4-5 mm long, bearing at the end 9-17 whitish filaments about 3 mm long; style about 3 mm long. Fruit almost globular, about 4 mm diameter, the more or less truncate apex bearing the woody remains of the calyx lobes. (Fig. 1.)

Mallee honey myrtle

Distribution (Map 1)

Western Australia, New South Wales, Victoria and South Australia.

Selection of Specimens examined

EYRE PENINSULA (7): *Eichler 19528*, 20 km E of Minnipa, 14.x.1967; *Kraehenbuehl 2029*, Hambidge C.P., 9.x.1966; *Rohrlach 64*, 10 km S of Kimba, 31.i.1959; *134*, Pinkawillinie, 15.ii.1959; *Wheeler 574*, 9 km S of Bascombe Well Homestead, 4.x.1967; *889*, Verran Hill track, 8.x.1968; *1036*, Hincks C.P., 11.x.1968.

NORTHERN LOFTY (8): *Copley 693*, Hd Wiltunga, 29.ix.1966 : *Jackson 517*, 5 km S of Reeves Plains, 6.viii.1963; *Lothian 3046*, 5 km W of Kulpara, 3.xi.1964; *Velleman 22*, Kulpara North, 13.ix.1975.

MURRAY (9): *Czornij 710*, 15 km W of Murray Bridge, 22.vii.1974; *Schodde 680*, between Coomandook & Yumali, 26.xii.1954; *Sharrad 132*, between Cooke Plains & Elwomple, 28.ix.1959; *Specht 2292*, Billiatt C.P., 13.x.1960.

YORKE PENINSULA (10): *Blaylock 765*, 6 km SSE of Moonta, 30.ix.1967; *1041*, 8 km Arthurton to Maitland, 6.x.1968; *Copley 4457*, 3 km S of Browns Beach, 29.viii.1974; *Donner 1869*, 15 km S of Bute, 12.x.1966; *Eichler 13952*, 8 km S of Corny Point, 25.ix.1957; *Weber 3756*, 6 km N of Port Rickaby, 2.vii.1974.

SOUTHERN LOFTY (11): *Hunt 3025, 3027*, Finniss, 12.ix.1969, *3413*, Currency Creek, 13.x.1972; *Kuchel 27*, 13 km W of Gawler, 17.vii.1962.

KANGAROO ISLAND (12): *Crisp 387, 388*, Sapphiretown, 26.viii.1971; *Ising s.n.*, Macgillivary, 30.xii.1922; *Jackson 209*, Kingscote, 16.ix.1962.

SOUTH-EASTERN (13): *Carrick 3406*, Scorpion Springs C.P., 21.x.1973; *Eardley s.n.*, Lake Robe, -.vi.1938; *Sharrad 192*, Malinong, 29.ix.1959.

Fig. 1. *M. acuminata.* A, twig, nat, size; B. leaf, upper surface, x 3; C, flower, x 5; D, stamen bundle, x 10; fruits, nat. size.

Fig. 2. *M. adnata.* A, twig, nat. size; B, leaf, obliquely lateral view, x 4; C, inflorescence, nat. size; D, flower, x 5; E, stamen bundle, x 8; F, fruits, slightly reduced.

2. **Melaleuca adnata** Turcz., Bull.Phys.-Math.Acad.Petersb.10(1852)343; F. Muell., Fragm.8(1874)184; Black, Fl.S.Austral.ed.2(1952)609; Blackall & Grieve, West.Austral.Wildfl.1(1954)297, in clave.

[*Type:* Western Australia, *Drummond V, 160* (MEL)]

Melaleuca eleutherostachya F. Muell. var. *abietina* Benth., Fl. Austral.3(1867)140.

[*Type:* Western Australia, *Drummond V, 160* (MEL); *J.S. Roe s.n.*]

Shrub to 2 m high, spreading to 2-4 m wide, older branches ashy, rough, branchlets white, young shoots and leaves slightly villous, some becoming glabrous. Leaves descussate, sessile, attached by a dorsal circular or elliptic areole near the base, plano-convex or somewhat concave above, erect-ascending, recurved in the upper half, narrowly ovate-lanceolate, acuminate, acute, smooth above, roughly glandular-gibbous below, veins obscure, 5-7 mm long, 1-2 mm broad. Inflorescence spicate, flowers crowded on short lateral branches which do not grow out, rachis hairy; calyx tube campanulate, villous at the base, about 1 mm long, lobes almost semicircular, with a narrow scarious margin, ribbed, strongly incurved, about 1 mm long; petals almost circular, very concave, very caducous, about 2 mm diameter; staminal claws 3-4 mm long, bearing on the upper half 10-15 yellowish filaments 3-4 mm long. Style about 7 mm long, not expanded at the apex, stigma terminal. Infructescence 1.5-2 cm long, about 1 cm diameter, composed of 25-50 closely compacted woody fruits, slightly contracted at the orifice, each 3-4 mm long and broad. (Fig. 2.)

Hummock honey-myrtle

Distribution (Map 2)

Western Australia and South Australia.

Selection of Specimens examined

NULLARBOR (3): *Chinnock 2660,* 1.5 km E of Immarna, 29.ix.1975; *Gianakos 3180,* 5 km E of Immarna, 14.ix.1970.

GAIRDNER-TORRENS BASIN (4): *Gardiner s.n.,* 12 km S of Lake Everard Homestead 15.vi.1969; *Lay 103,* 40 km S of Mt Finke, 29.x.1970; *Weber 3192,* 15 km S of Lake Everard Homestead, 26.ix.1972.

EYRE PENINSULA (7): *Cleland s.n.,* Koonibba, 18.viii.1928, 5.vi.1946; *s.n.,* 50 km NE of Cowell, 6.xi.1936. *Copley 2472,* 50 km N of Cowell, 27.i.1969. *Hall s.n.,* 75 km S of Port Augusta, 23.i.1971. *Hilton 1618,* 16 km W of Minnipa, 20.viii.1955; *Ising s.n.,* Moonabie, 6.xi.1936; *s.n.,* Wudinna, 5.ix.1938; 9.ix.1938; *s.n.,* 19 km N of Minnipa, 14.ix.1938; *Kraehenbuehl 2094,* Hambidge C.P., 10.x.1966; *Lothian 4047,* 55 km NE of Wirrulla, 4.vi.1967;. *Orchard 2939,* Iron Duke, 29.xi.1970; *Reid s.n.,* Lake Everard, 31.iii.1960; 30.ix.1966; *s.n.,* Euria W.H., 3.x.1966; *Rohrlach 307,* Pinkawillinie, 17.iv.1959; *Scoles 3,* 30 km NE of Wirrulla, 10.vi.1967; *Shaw s.n.,* Iron Duke, -.iii.1962; *Spooner 2449,* 25 km S of Hiltaba, 5.ix.1972; *Symon s.n.,* 22 km N of Koonibba, 30.ix.1959; *8188C,* 6 km NW of Pine Lodge, 6.x.1972; *8222,* Koondoolka, 10.x.1972.

Notes

Turczaninow (1852) based his description of *M. adnata* on Drummond's 5th collection, no. 160. Mueller (1862, p.117) described an Oldfield collection from Western Australia [MEL, seen by Carrick] as *M. eleutherostachya.* Bentham (1867), apparently unaware of Turczaninow's publication, described Drummond's 5th collection, no. 160 [together with *Roe s.n.*] as *M. eleutherostachya* F. Muell. var. *abietina* Benth. Mueller (1874) refers to Turczaninow's paper and makes numerous changes, placing *M. eleutherostachya* in synonymy under *M. adnata,* and this is followed by Blackall & Grieve (1954). Black (1952) placed *M. eleutherostachya* and var. *abietina* under *M. adnata.* Beard (1970) maintained *M. adnata* and *M. eleutherostachya* as distinct species.

The original descriptions indicate distinctive differences between the two taxa, which have been confirmed on the types examined, particularly in the size of the leaves, the length of the staminal claws and the number of filaments, and it seems appropriate to retain *M. eleutherostachya* as a separate Western Australian species until its proper taxonomic position is determined. The South Australian collections belong to *M. adnata.*

3. **Melaleuca bracteata** F. Muell., Fragm.1(1858)15; Fragm.8(1874)184; Benth., Fl.Austral.3(1867)144; Eichler, Suppl.Black's Fl.S. Austral.(1965)233; Blake, Contr. Queensl.Herb.1(1968)65.

[*Type:* Queensland, Moreton Bay, *W. Hill s.n.* (MEL, lecto.); fide Blake (1968)65.]

Melaleuca glaucocalyx Gandoger, Bull.Soc.Bot.France 65(1918)26.

[*Type:* New South Wales, Murwillumbah, *Forsyth s.n.* (LY, holo.; BRI, NSW); fide Blake (1968)54.]

Melaleuca genistifolia Sm, var. *coriacea* Ewart, Kerr & Derrick, Proc.Roy.Soc.Vict.ser.II,38(1926)84.

[*Type:* Northern Territory, Finke River, *Kempe 431*(MEL); Arltunga, *Ewart s.n.* (? MEL); fide Blake(1968)54.]

Melaleuca monticola Black, Trans.Roy.Soc.S.Austral.58(1934)179; Fl. S.Austral. ed.2(1952)610.

[*Type:* South Australia, near Ernabella, *Cleland s.n.* (AD); Glen Ferdinand, *S.A. White s.n.* (AD) lecto., hic Carrickio designatus.]

Melaleuca daleana Blakely, Austral.Nat.11(1941)9.

[*Type:* Northern Territory, Connor's Well, *Dale s.n.* (NSW, holo.); fide Blake (1968)65.]

Tall shrub or small tree, 2-5 m high, sometimes with several stems from the base, intricately branched, bark greyish, rough, fissured, young branches and leaves pubescent becoming glabrous. Leaves crowded towards the ends of the branchlets, scattered, stiff, erect-ascending, sessile, narrowly elliptic-lanceolate, acute, 4-8 (rarely 10) mm long, about 1.5 mm broad, more or less concave above, obscurely 3-4-nerved, both surfaces copiously gland-dotted, sometimes obscurely so. Inflorescence a loose terminal spike, sometimes few-flowered, the axis soon growing out, rachis pubescent, bracts leaf-like but shorter, broader and more or less persistent; calyx tube shortly cylindric, about 2 mm long and broad,

pubescent ouside, lobes ovate-acute or more or less triangular, sometimes shortly pointed, about 1 mm long and broad, pubescent outside, almost glabrous inside, sub-persistent; petals broadly ovate, concave, not clawed, about 2 mm long and 1.5 mm broad; stamens pale yellow, claws 2-3 mm long, bearing 15-25 filaments 2-3 mm long borne laterally from the middle and in two rows at the apex; style about 7 mm long, not expanded at the apex, stigma terminal, flat. Fruit hemispherical to shortly cylindrical, base rounded apex truncate, 2-2.5 mm long, 2.5-3 mm diameter, crowned by the lobes or, in older fruits, bearing the woody bases of the lobes as narrow rounded ridges. (Fig. 3.)

Bracteate honey-myrtle

Distribution (Map 2)

Western Australia, Northern Territory, Queensland, New South Wales and South Australia.

The disjunct distribution of this species in South Australia is noteworthy.

Specimens examined

NORTH-WESTERN (1): *Brumby s.n.*, Ernabella, 1937; *Cleland s.n.*, 25 km SW of Ernabella, 7.viii.1933; 8.viii.1933; *s.n.*, Ernabella, 26.ix.1945; *s.n.*, Kenmore Park, 15.iv.1950; *s.n.*, Mann Ranges, 21.viii.1954; *s.n.*, Musgrave Park, 2.vii.1961; *Reid s.n.*, Kenmore Park, 11.viii.1953; *Symon 2161*, 10 km W of Musgrave Park, 30.vii.1962; *2616*, Piltardi Creek, 9.viii.1962; *2704*, Kenmore Park, 12.viii.1962; *2697*, 48 km NW of Kenmore Park, 12.viii.1962; *Weber 243*, 30 km W of Musgrave Park, 2.xi.1966; *Whibley 992*, 17 km W of Musgrave Park, 6.ix.1963; *White 9*, Glen Ferdinand, 19.vii.1914; *Wilson 2528*, Piltardi, 8.viii.1962; *2578*, Kenmore Park, 12.viii.1962.

FLINDERS RANGES (5): *Saddler s.n.*, Upper Balcanoona Creek, 30.xi.1964; *Symon 3008*, Grindell's Hut Gorge, Balcanoona, 11.x.1964.

Fig. 3. *M. bracteata.* A. twig, nat. size; B, leaf, lower surface, x 4; C, flower, x 4; D, stamen bundle, x 8; E, fruits, slightly reduced; F, fruit, x 3.

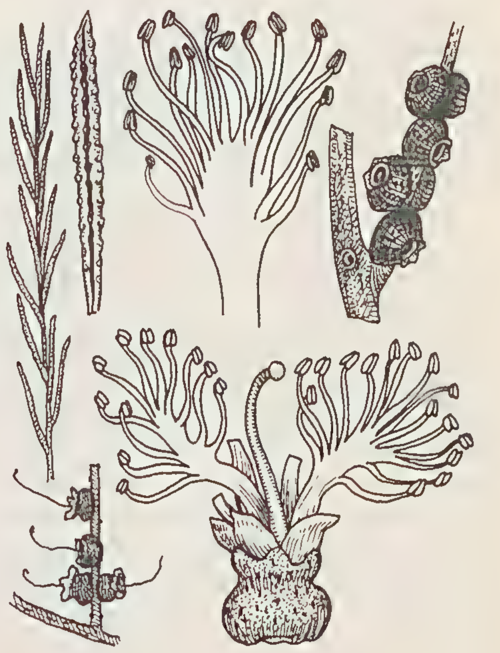


Fig. 4. *M. corrugata.* A, twig, nat. size; B, leaf, upper surface, x 4; C, flower, x 2; D, stamen bundle, x 3; E, young fruit, nat. size; F, mature fruit, slightly reduced.

4. **Melaleuca corrugata** Black ex Eardley, in Black, Fl.S.Austral. ed.2(1957)945; ibid., (1952)609, t.807; Eichler, Suppl.Black's Fl.S.Austral.(1965)232.

[*Types:* South Australia, summit of Mt Woodroffe, Musgrave Ranges, *Cleland s.n.,* (AD95701003, holo; AD95927021, AD97232108, CANB, K.)]

Tall shrub, much-branched from the base, 2-3 m high, branches dark grey or almost black, bark almost smooth. Leaves crowded on the young branchlets, more or less erect, very shortly petiolate or sessile, decussate, narrowly elliptic-lanceolate, cuneate, acute, appearing almost linear because of the strongly incurved margins, 1-nerved, 5-20(-30) mm long, 1-2 mm broad, upper surface smooth, lower surface with many prominent protruding glands, strongly scented of *Eucalyptus* when crushed. Flowers solitary, in spikes 2-4 cm long, formed at the base of incipient lateral branchlets, the axis soon growing out, subtending bracts broadly ocate, acuminate, concave, attached by a broad base, 4 mm long, 2.5 mm broad, caducous. Calyx tube flask-shaped, the lower part depressed-spherical, base flat, contracted above, 2.5-3.5 mm long, 3.5-4.5 mm diameter, lobes broadly ovate and obtuse or more or less rounded, about 1 mm long, 2 mm broad at the base; petals pinkish or white, broadly oblong or almost circular, slightly concave, 4.5-5 mm long, 3.5-4 mm broad, claw very short; stamens pale yellow, claw 6-7 mm long, bearing 25-35 filaments 6-8 mm long marginally from near the base and in two or three rows at the apex; style about 12 mm long, expanded at the apex, the stigma forming a circular rim around the central depression. Fruit grey or almost black, rough with the whitish scaly remains of the outer tissues giving the appearance of a "network of shallow depressions", depressed-spherical, base rounded, apex contracted and produced upwards bearing the remains of the bases of the calyx lobes, 6-7 mm long, 9-10 mm diameter, aperture 3-4 mm across. (Fig.4.)

Wrinkled honey-myrtle

Distribution (Map 3)

Probably also Northern Territory.

Specimens examined.

NORTH-WESTERN (1): *Cleland s.n.,* Mt Woodroffe, 18.iv.1950; *Hill & Lothian 687,* Mt Woodroffe, 28.vi.1958; *694,* Mitchell's Nob, 29.vi.1958; *Kuchel 316,* Mt Lindsay, 6.viii.1962; *Reid s.n.,* Mt Lindsay, 26.vi.1967; *Symon 2569,* Mt Lindsay, 6.viii.1962; *2681,* Mt Woodroffe, 11.viii.1962; *Spooner 132,* Mt Illbillee, -.ix.1968; *Wilson 2498,* Mt Lindsay, 6.viii.1962.

The script by Black on the holotype sheet cites "summit of Mt Woodroffe, Everard Range" in error.

5. **Melaleuca decussata** R.Br. ex Ait.f., Hort.Kew.ed.2(1812)415; DC., Prodr.3(1828)214; Benth., Fl.Austral.3(1867)133; Tate, Fl.Extratrop.S.Austral.(1890)92 in clave,231; Black, Fl.S.Austral.ed.1(1926)407, ed.2(1952)607, t.804; Eichler, Suppl.Black's Fl.S. Austral.(1965)232.

[*Type:* "Native of the South Coast of New Holland. *Robert Brown,* Esq. *Introduced* 1803, by Mr Peter Good."]

Melaleuca tetragona Lodd.ex. Otto, Horae Phys.Berol.(1820)37:

[*Type:* "Hort. Loddigens."]

Melaleuca parviflora Reichb., Ic.Bot.Exot.(1824)t.31.

[*Type:* "Habitat in Nova Hollandia. *Explic.*Specimen cultum."]

Melaleuca pumila Otto ex DC., Prodr.3(1828)214; nom nud., in syn.

Melaleuca elegans Hornsch., Allg.Gartenz.2(1834)329.

[*Type:* Grown in the Berlin Bot.Gard. from seed from "Swan River."]

Melaleuca oligantha F.Muell. ex Miq., Nederl. Kruidk.Arch.4(1859)123.

[*Type:* New South Wales, without locality or collector, in Herb. Mueller.]

Melaleuca decussata var. *ovoidea* Black, Trans.R.Soc.S.Austral.49(1925)275.

[*Types:* "Kangaroo Island; Encounter Bay; Goolwa; southern Yorke Peninsula; South-East." Lecto., hic Carrickio designatus: South Australia, between Kingscote and Karatta, *Ayliffe s.n.,* (AD97631325).]

Tall slender shrub, usually 2-3 m high, sometimes attaining 6 m, branchlets white becoming dark grey, bark rough, fissured. Leaves sessile, more or less erect, decussate, linear to oblanceolate, cuneate, obtuse, concave above, glandular below, obscurely 3-veined, 5-15 mm long, 1-3 mm broad. Flowers in short lateral heads or spikes which are usually barren, or in fertile spikes at the bases of leafy branches, rachis glabrous; bracts narrowly ovate or ovate-acuminate, concave, glabrous, 3-5 mm long, 1-2 mm broad; bracteoles not seen; calyx tube sessile by a broad flat base, glabrous, about 1 mm long, lobes broadly rounded, about 0.5 mm long, 1 mm broad; petals purplish, almost spherical, about 2 mm long and broad, claw very short; stamens purple, claw about 0.5 mm long bearing 10-18 filaments 3-4 mm long in two series at the broad apex; style about 4 mm long, scarcely expanded at the apex, stigma convex. Fruit eventually deeply embedded in the thickened woody rachis, about 3-5 mm diameter, aperture about 2 mm across. (Fig. 5.)

Cross-leaf honey-myrtle; totem-poles

Distribution (Map 3)

Victoria and South Australia. Note that only one record is known from the South East region and two from Kangaroo Island.

Selection of Specimens examined

EYRE PENINSULA (7): *Alcock s.n.*, Hd Mortlock, -.x.1976. *Cleland s.n.*, Mt Dutton, 1.vi.1923. *Copley 2804*, Wharminda, 27.ix.1969. *Eichler 19313*, 7 km ENE of Bascombe Well Homestead, 6.x.1967. *Fagg 466*, 42 km S of Cummins, 25.xi.1967. *Orchard 3078*, Marble Range, 2.i.1971; *3039*. *Phillips s.n.*, 78 km from Port Lincoln towards Elliston, 22.ix.1965; *Specht 2097*, Blue Range, 9.xii.1959. *Symon 912*, Koppio road turnoff, 12.xi.1960. *Wheeler 569A*, 7 km SW of Bascombe Well Homestead, 3.x.1967.

YORKE PENINSULA (10): *Blaylock 1655*, Hd Ramsay, 29.xii.1970. *Carter s.n.*, Hd Carribie, 20.v.1962. *Orchard 2836*, 16 km NE of Foul Bay, 15.xii.1970. *Quinn 4*, Hardwicke Bay, 10.xii.1972. *Williams 7585*, 16 km WSW of Warooka, 22.i.1976.

SOUTHERN LOFTY (11): *Ashby s.n.*, Kangarilla, 4.xii.1920.*Carrick 3009*, 8 km N of Goolwa, 11.xi.1971. *Cleland s.n.*, Clarendon, 20.x.1913, 13.x.1920. *Crisp 49*, Cox's Scrub, 13.xii.1970. *Czornij 94*, 8 km NE of Waitpinga, 10.xi.1966. *Donner 437*, Mylor, 9.xii.1961. *Fieldhouse 99*, Cox's Scrub, 16.x.1975. *Grivell s.n.*, Currency Creek, 27.iv.1969. *Haegi 286*, 5 km S of Ashbourne, 1.iv.1973. *Ising s.n.*, Victor Harbour, 21.xi.1909. 18.i.1926. *Kraehenbuehl 1582*, 1 km N of Tanunda, 27.xi.1965.

KANGAROO ISLAND (12): *Ayliffe s.n.*, between Kingscote & Karatta, -.i.1907. *Cooper s.n.*, 24 km W of Cygnet River P.O., 2.i.1945.

SOUTH-EASTERN (13): *Hunt 1443*, The Gap, between Bordertown and Naracoorte, 8.xii.1962.

Comments

The production of spikes or short lateral heads composed only of male flowers, on plants which also produce spikes of hermaphrodite flowers, is a character frequently found in this species, and was noted also by Bentham (1867) and Willis (1972). These male flowers can be distinguished by the abortive ovary and the extremely short undeveloped style, as well as by the rounded base of the calyx tube. This latter feature, and the somewhat broader leaves, were the basis for Black's variety *ovoidea*. The type sheet of var. *ovoidea* has in Black's handwriting: "fls.all *male* in short or oblong ovoid heads", which is not in the original description, but was included in 1952. In fact, the flowers on the type are hermaphrodite and produce seeds. In other specimens examined, spikes of flowers with rounded bases were male and possessed normal leaves. Black (1925) lists a wide distribution for var. *ovoidea* which seems to have been based on the rounded calyx tube. The type specimen is 15 cm long, the end of a branch with a few branchlets, and there is no way of knowing whether older parts of the plant bore normal fertile inflorescences. Until there is further evidence derived by comparison with more complete material, particularly from the rather vague locality on Kangaroo Island, it is considered advisable not to recognize this variety.

Fig. 5. *M. decussata.* A, twig, x ¾; B, leaf, lower surface, x 3; C, flower, x 7; D, stamen bundle, x 10; E, fruits, nat. size.

Fig. 6. *M. dissitiflora.* A. twig, x ¾; B, leaf, lower surface, x 1½; C, inflorescence, x ¾; D, flower, x 4; E, stamen bundle, x 8; F, fruits, nat. size; G, fruit, x 3.

6. **Melaleuca dissitiflora** F. Muell., Fragm.3(1863)153; Benth., Fl.Austral.3(1867)144.

[*Type:* "Inter flumen Bonney et montem Morphett (Northern Territory) J. Macd. Stuart. (MEL).]

Melaleuca trichostachya [non Lindl.] sensu Tate, Fl.Extratrop.S.Austral.(1890)92.

Melaleuca linophylla [non F. Muell.] sensu Black, Fl.S.Austral.ed.1(1926)409.

Melaleuca linophylla [non F. Muell.] sensu Eichler, Suppl.Black's Fl.S.Austral.(1965)233.

Tall shrub to about 5 m high, young shoots slightly pubescent, branchlets green, branches pale grey, slightly fissured, bark of main stems somewhat papery. Leaves glabrous, scattered, narrowly linear-lanceolate, cuneate, acute, 2-3.5 cm long, rarely longer, 2-2.5 mm broad, flat or slightly concave above, obscurely 3-veined, very shortly petiolate. Spikes loose, on the young branchlets which soon grow out, rachis glabrous; flowers solitary, bract glabrous, 5-8 mm long, the basal part about 1 mm, broadly elliptic, concave, enclosing the flower bud, the upper part narrowly acuminate-acute, bracteoles absent, or very caducous; calyx glabrous or slightly pubescent outside, tube campanulate, about 2 mm long, scarcely contracted at the apex, lobes deltoid, about 1 mm long, 1 mm broad at base, pubescent inside, semi-persistent; petals white, slightly pubescent inside, broadly oval, about 2 mm long, claw short; stamens whitish, claw about 3 mm long bearing 15-25 filaments 2-3 mm long in two series on the upper half; style about 5 mm long, slightly expanded at the apex, stigma convex. Fruit grey, globose, slightly flattened, constricted at the apex, 2-3 mm diameter, aperture 1-2 mm across. (Fig. 6.)

Distribution (Map 3.)

Northern Territory, Queensland and South Australia.

Specimens examined

NORTH-WESTERN (1): *Cleland s.n.*, 16 km N of Ernabella, 16.viii.1933; *s.n.*, Piltardi Rockhole, 21.viii.1954; *s.n.*, Mann Ranges, 21.viii.1954; *s.n.*, Piltardi, 17.vi.1955; 4.vii.1961. *Reid 70*, Mann Ranges, 21.ix.1955; *s.n.*, Piltardi, 28.ix.1955. *Symon 2622*, Piltardi Creekline, 9.viii.1962; *2631*, 72 km W of Musgrave Park Homestead, 9.viii.1962. *Turvey s.n.*, Ernabella, 21.vii.1966. *Wilson 2526*, Piltardi Gorge, 8.viii.1962.

LAKE EYRE BASIN (2): *Cleland s.n.*, Coopers Creek, Innamincka, 29.v.1924. *Kuchel 2638*, Mt Hopeless road, 22.viii.1968.

FLINDERS RANGES (5): *Carrick 2028*, Paralana Springs, 24.viii.1968. *Donner 1124*, 3 km E of Nepabuna Mission, 1.ix.1964. *Freckleton 48*, Mt Serle Homestead, 6.ix.1965. *Gill s.n.*, Farina, -.v.1907. *Koch 419*, Mt Lyndhurst, -.ix.1898, -.xii.1898, -.viii.1899. *Kuchel 3056*, Arkaroola hot springs, 22.x.1971. *Lothian 2497*, Nepabuna Mission, 27.ix.1963; *4227*, 2 km W of Mulga View Homestead, 18.x.1967. *Rohrlach 640*, Arcoona Creek, 10.x.1959. *Schodde 836*, Mt Chambers Gorge, 2.ix.1958. *Symon 2989*, Grindells Hut, 12.x.1964; *4002*, Mt McKinley, 5.iii.1966; *5940*, Moolawatana Homestead, 22.viii.1968; *6053*, Paralana Springs, 24.viii.1968. *Whibley 2218*, between Wirrealpa and Blinman, 12.ix.1973.

Comments

Melaleuca dissitiflora closely resembles *M. linophylla* in vegetative characters, and the scarcity of specimens has led to some confusion, but it seems sufficiently distinct to be retained as a separate species until more adequate collections of *M. linophylla* are available.

Mueller (1862), in his description of *M. linophylla*, drew attention to the stamens, at most seven in each bundle and the phalanges (= total length?) 3-4 mm, and also to the fruit as being minute. "Stylus tantum 1‴ longus" is probably in error, because the flower is more or less protandrous, the style being the last organ to develop, and in newly opened flowers of other species it has been observed only 1 mm long. Mueller (1863), in his description of *M. dissitiflora*, regarded it as being close to *M. linophylla*, the main differences cited being in the widely spaced larger flowers, and the many filaments in each staminal bundle. He saw no fruits.

Bentham (1867), with only the type collections available, admitted both species, but suggested that *M. dissitiflora* may be but a variety of *M. linophylla*. He noted the difference in size of the flowers including the length of the staminal bundles, and the greater number of filaments in *M. dissitiflora*.

The description given by Black (1926) under *M. linophylla* fits *M. dissitiflora* more closely. Black (1952) omitted it from his second edition, and Eichler (1965) reinstated it. Collections at AD were annotated *M. linophylla*. However, Eichler realized that the name may have been misapplied, and sought an opinion from S.T. Blake, who wrote (pers. comm., 1972):

> "*Melaleuca linophylla* is known to me only from the type and a collection of Burbidge's from S. of Port Hedland. I am enclosing a photograph of the type with my sketch of the calyx, a petal and a staminal bundle. Most of the flowers are immature. The specimen resembles some specimens of *M. dissitiflora* at first sight, but the flowers are smaller, the calyx usually hairy and the staminal bundles have fewer (6-11) filaments mostly in the upper part. The type of *M. dissitiflora* has widely spaced flowers but this is an accidental feature that is also often seen in *M. lanceolata, M. bracteata* and other species. In recent years *M. dissitiflora* has been found near Cloncurry in north-western Queensland though I have not found it myself."

Examination of the types at MEL confirmed this and showed also that the fruits of *M. linophylla* are cylindrical, about 1.5 mm long, 1.5 mm in diameter.

M. dissitiflora differs from *M. linophylla* in having larger flowers, longer staminal bundles with more filaments and larger sub-globose fruits. *M. linophylla* appears to be restricted to north-west Western Australia; *M. dissitiflora*, apart from its distribution in South Australia, occurs in south-central Northern Territory and north-western Queensland.

7. **Melaleuca gibbosa** Labill., Nov.Holl.Pl.Spec.2(1806)30, t.172; DC., Prodr.3(1828)215; Benth., Fl.Austral.3(1867)133; Tate, Fl.Extratrop.S.Austral.(1890)92, in clave, 231; Black, Fl.S.Austral., ed. 1(1926)407, ed.2(1952)607; Curtis, Fl.Tasm., ed.1(1956)201, ed.2(1975)204; Willis, Handb.Pl.Vict.2(1972)453.

[*Type:* "In terra Van-Leuwin" (Western Australia, but probably actually collected in Tasmania). *Labillardiere.*]

Tall glabrous shrub, usually 2-3 m high, branchlets white becoming dark grey, bark rough. Leaves sessile, spreading or more or less erect, decussate, ovate to obovate, subacute, concave above, keeled and glandular below, 3-veined, 2-6 mm long, 1-4 mm broad, often recurved in upper part, thick and rigid.Flowers decussate in lateral heads which soon become short spikes emitting leafy branches, rachis glabrous; bracts resembling the leaves but caducous before the flowers open; bracteoles not seen; calyx tube sessile by a broad flat base, glabrous, about 1.5 mm long and 2 mm broad, lobes very short to 0.5 mm long, 1 mm broad, almost truncate, scarious, caducous; petals purplish, about 1.5-2 mm long, 2 mm broad; stamens purple to pink, claw much shorter than petals bearing 15-20 filaments 2.5-3.5 mm long in two series at the broad apex; style about 3 mm long, scarcely expanded at the apex, stigma convex. Fruit eventually partially embedded in the thickened woody rachis, about 3-4 mm diameter, aperture about 2-3 mm across. (Fig. 7.)

Slender honey-myrtle

Distribution (Map 4)

Victoria, Tasmania and South Australia.

Selection of Specimens examined.

[EYRE PENINSULA (7): *Williams 9144,* 41 km W of Kyancutta, 17.ii.1977 (Herb. Ecological Survey of S.A.).]

YORKE PENINSULA (10): *Alcock 4566,* Innes National Park, 6.x.1974. *Cleland s.n.,* Marion Bay, 12.iv.1936. *Eichler 14059,* near Cape Spencer, 28.ix.1957. *Pretty 2,* Warrenben Hut, 4.v.1969. *Specht s.n.,* Pondalowie Bay, 5.ii.1959.

KANGAROO ISLAND (12): *Black s.n.,* Kingscote, -.v.1914. *Cleland s.n.,* between Kingscote & Vivonne Bay, 16.xi.1924. *Jackson 351,* dam off Playford Highway, 3.xii.1963. *Mrongovius 37,* Eleanor River bridge, 1.vi.1972. *Phillips s.n.,* Cape Borda, 29.viii.1964. *Spooner 3794,* Harvey's Return, 12.xii.1974. *White s.n.,* Middle River, -.xii.1911. *Wilson 740,* Kelly Hill, 5.xi.1958.

SOUTH-EASTERN (13): *Black s.n.,* Bubbling Spring, 28.xii.1933. *Cleland s.n.,* Lake Bonney, 7.xii.1922; *s.n.,* 8-mile Creek, 31.x.1941; *s.n.,* Point Douglas, 3.xi.1941; *s.n.,* near Kingston, 4.vi.1965. *Copley 3347,* 25 km S of Robe, 14.i.1971. *Eileen 180,* Yallum, s.d. *Hunt 459,* ca. 30 km south-west of Naracoorte, 25.xi.1961. *Ising s.n.,* near Lucindale, 13.xii.1934; *s.n.,* Penola, 13.xi.1935. *Petherick s.n.,* Naracoorte, 27.xi.1933. *Roach 81,* ca. 3 km E of Lucindale, 29.xii.1970. *Tate s.n.,* Mt Julian, 24.xi.1882. *Weber 1930,* Big Heath, 8.xi.1969. *Welbourn 149,* Fairview Estate, 15.xii.1963. *Wilson 819,* Marsh's Swamp, 13.i.1968.

Comments:

M. gibbosa is similar to *M. decussata* in the broad base to the calyx tube, the purplish flowers, short staminal claw bearing about 15 filaments and the fruits eventually embedded in the enlarged woody rachis. The main distinguishing feature is in the leaves, which in *M. decussata* are linear or rarely oblanceolate, the apex straight or slightly incurved, obscurely veined and 5-15 mm long, while in *M. gibbosa* they are ovate or obovate, often recurved and distinctly 3-veined and 2-6 mm long. Willis (1972) has referred to one particular Victorian population of suspected hybrids between these two species.

[Carrick apparently intended to distinguish two varieties or subspecies of this species; one from Yorke Peninsula and Kangaroo Island with leaves about 3 mm or more long and then a new taxon from the South-East with shorter leaves. However, he did not prepare any descriptions and the differences appear likely to break down if the small sample of Victorian and Tasmanian specimens available in Adelaide is anything to go on. Two collections from near Naracoorte and Millicent in the South East region may be of this species but have 3-veined leaves to about 3 mm long but somewhat obtuse, not recurved and elliptic to oblanceolate.]

Fig. 7. *M. gibbosa.* A, twig, nat. size; B, leaf, lower surface, x 6; C, flower, x 6; D, stamens, x 6; E, mature fruits, x 1½; F, older fruits, x 1½.

Fig. 8. *M. glomerata.* A, twig, x ¾; B, leaf, x 1½; C, flower, x 6; D, stamen bundle, x 8; E, fruits, x 1/3.

8. **Melaleuca glomerata** F. Muell., Rep.Babbage Exped.(1859)10; Benth., Fl.Austral.3(1867)151; Tate, Fl.Extratrop.S.Austral.(1890)92, in clave, 231; Black, Fl.S.Austral.ed.1(1926)409, ed.2(1952)610, t.812; Blackall & Grieve, West.Austral.Wildfl.1(1954)300, in clave; Eichler, Suppl.Black's.Fl.S.Austral.(1965)233.

[*Types:* "Lake Gregory, Arcoona, Lake Campbell. Occurs also on Sturt's Creek in the interior of N.W. Australia."]

Melaleuca hakeoides F. Muell. ex Benth., Fl.Austral.3(1867)151.

[*Type:* "New South Wales, Mount Goningberi, near Cooper's Creek, *Victoria Expedition.*"]

Low bushes to tall shrubs 2-8 m high; branchlets grey; bark papery. Leaves narrowed towards the base but sessile, alternate, narrowly oblanceolate, acute, with a very short hard point, more or less compressed, densely grey-tomentose or almost glabrous, 1.5-5 cm long, about 2 mm broad. Flowers in dense globular terminal heads, the axis growing out into a leafy branch after flowering, rachis pubescent; bracts broadly ovate, about 1.5 m broad and 1 mm long, pubescent; bracteoles not seen; calyx tube sessile by a broad flat base, pubescent, about 1 mm long, lobes broadly ovate, to about 0.5 mm long, slightly broader than long; petals broadly ovate, about 1.5 mm long and broad, claw very short; stamens yellow, claw about 1 mm long bearing 4-8 filaments 2.5-4.5 mm long in two series at the broad apex; style about 4 mm long, scarcely expanded at the apex, stigma convex. Fruiting clusters dense, globular, 4-6 mm diameter and composed of 5-14 globular truncate 3-celled fruits about 1.5 mm diameter, aperture about 1 mm across. (Fig. 8.)

White tea-tree

Distribution (Map 4)

Western Australia, Northern Territory, New South Wales and South Australia.

Selection of Specimens examined

NORTH-WESTERN (1): *Black s.n.*, Mt Illbillie, 3.viii.1914. *Brundy s.n.*, Ernabella, 1937. *Eichler 17372*, near summit of Mt Morris, 7.ix.1963; *17458*, gorge north of Victory Well, 12.ix.1963. *Forde 921*, Officer Creek, -.ix.1957. *Reid, W.C. 68*, Mann Ranges, 21.ix.1955. *Symon 2615*, Piltardi Creek 9.viii.1962; *3343*, between Betty & Ronald Well, -.ii.1965. *Weber 244*, ca. 25 km west of Musgrave Park Station, 2.xi.1966. *White s.n.*, Glen Ferdinand, 19.cii.1914. *Wilson 2565*, Mt Woodroffe, 10.viii.1962.

LAKE EYRE BASIN (2): *Aitken s.n.*, Stuart Creek Waterhole, 10.xii.1964. *Black s.n.*, Murnpeowie Station, 26.vii.1920. *Cleland s.n.*, Lake Blanche, -.vi.1924. *Hill 252*, Muloorina Station, 25.vii.1955, *498*, 14.xi.1955, ca. 8 km north of Marree. *Ising s.n.*, south of Charlotte Waters, 6.ix.1932. *Lothian 1404*, Dalhousie Springs, 8.viii.1963. *Mattner 26*, Strzelecki Track, 21.vi.1971. *White s.n.*, Petermorra Springs, -.ix.1912.

GAIRDNER-TORRENS BASIN (4): McDouall Peak, *Black s.n.*, -.v.1917.

FLINDERS RANGES (5): *Beck, s.n.*, Moolooloo Station, -.x.1920. *Black s.n.*, Nepabunna, -.viii.1937. *Cleland s.n.*, Leigh Creek, 15.x.1917; *s.n.*, Wirrealpa, 2.xii.1931. *Eichler 12874*, mouth of Arcaroona Creek gorge, 21.ix.1956. *Freckleton 49*, Mt Serle Homsetead, 6.ix.1965. *Schodde 827*, St Georges Bluff, 2.ix.1958. *Symon 4037*, Muldara Rock. 4.iii.1966.

EASTERN (6): *Crisp 748*, Bibliando Station, 13.iv.1974. *White s.n.*, Lake Frome Basin, -.xii.1920. *Williams 7419*, Hamiltons Creek, Lake Callabonna, 22.xi.1975.

9. **Melaleuca halmaturorum** F. Muell. ex Miq., Nederl.Kruidk.Arch.4(1859)122; Cheel,Trans.R.Soc.S.Austral.43(1919)369; Black, Fl.S.Austral. ed.1(1926)407, t.38; ed.2(1952)608, t.806; Ewart, Fl.Vict.(1931)861; Eichler, Suppl.Black's Fl.S.Austral.(1965)232; Willis, Hdbk.Pl.Vict.2(1972)453.

[*Type:* Kangaroo Island, "Ad flumen Three-Wells-river insulae Halmaturorum. *H. Heuzenroeder.*"]

Melaleuca pustulata [non Hook.f.] sensu Benth., Fl.Austral.3(1867)160, pro parte; [non Hook.f.] sensu Tate, Fl.Extratrop.S.Austral.(1890)93, in clave, 231.

Bushy shrub to 2 m or straggling much-branched tree to 7 m high, branchlets white, glabrous or finely pubescent when very young, branches with greyish papery deciduous bark. Leaves decussate, crowded, glabrous, ascending or spreading, petiole flat, appressed, about 1 mm long, lamina flat or slightly concave, more or less recurved, thick, smooth above, glandular-tuberculate below particularly when young, nerves obscure, linear-lanceolate, obtuse or somewhat acute, 3-7 mm long, 1-2 mm broad. Flowers in loose terminal spikes of 3-7, subtended by several pubescent, ovate, acuminate, acute bracts, the rachis also pubescent, the apex growing out; bracteoles apparently absent; calyx tube cup-shaped, glabrous, about 2 mm long, 1.5 mm broad, lobes triangular-acuminate-acute, glabrous outside, pubescent inside, about 1.5 mm long, 1 mm broad at base, semi-persistent; petals white, almost circular, about 2 mm long, claw very short; stamens whitish, claw about 1.5 mm long bearing 6-12 filaments 3-4 mm long near the apex; style about 8 mm long, slightly expanded at the apex, stigma flat. Fruits in small groups, woody, whitish-scaly, remains of calyx lobes often present, more or less cylindrical, not constricted at the apex, 3-3.5 mm long, 3.5-4 mm diameter. (Fig. 9.)

Kangaroo honey-myrtle; salt paper-bark

Distribution (Map 5)

Victoria and South Australia.

Selection of Specimens examined

EYRE PENINSULA (7): *Carrick 4021, 4025*, Spalding Cove, 22.x.1976. *Copley 2352*, 16 km SE of Streaky Bay, 13.x.1968. *Kuchel 1351*, Hambridge C.P., 22.x.1963. *Phillips s.n.*, 64 km from Elliston towards Port Lincoln, 4.ix.1962. *Specht 2127*, North Pearson I., 15.ii.1960. *Wilson 2669*, Stamford Hill, 21.v.1963.

MURRAY (9): *Cleland s.n.*, Chaunceys Line, 25.xi.1949. *Hilton 1535*, Samphire Swamp, 2.viii.1955. *Wheeler 102*, 20 km S of Murray Bridge, 27.x.1966.

YORKE PENINSULA (10): *Carrick 3895, 3896*, Innes N.P., 5.x.1974. *Eichler 14084A*, Marion Bay, 28.ix.1957. *Lothian 2601*, 20 km SW of Warooka, 13.x.1963. *Quinn s.n.*, 5 km NE of Yorketown, 26.ii.1971. *Weber 4244*, Royston Head, 11.x.1974.

SOUTHERN LOFTY (11): *Hunt 3073*, Hindmarsh River, 19.x.1969. *Fagg 114*, Outer Harbour, 31.x.1965. *Kraehenbuehl 231*, Camden, 31.x.1960. *Kuchel 474*, Torrens I., 22.iv.1963. *Smith 1536*, West Beach, 28.x.1968. *Spooner 3731*, Goolwa, 26.x.1974.

KANGAROO ISLAND (12): *Crisp 369*, Sapphiretown, 25.viii.1971. *Eichler 15465*, American River, 13.xi.1958. *Jackson 400*, 3 km W of Shoal Bay turnoff, 18.xii.1964. *Noble 608*, Pelican Lagoon, 7.iii.1973. *Wilson 895*, 3 km WSW of Kingscote, 13.xi.1958.

SOUTH-EASTERN (13): *Alcock 3098*, Eagle Nest Swamp, 10.xi.1969. *Carrick 2250, 2255*, Salt Creek to Meningie, 21.vii.1969. *Eichler 17758*, Bool Lagoon, 14.xii.1963. *Kuchel 2792*, 8 km S of Currawong, 13.ix.1968. *Stauffer 5399*, 31 km N of Kingston, 17.xi.1963.

Comments

Miquel (1859) published a description of *M. halmaturorum* and two varieties, var. *enervis* and var. *tuberculifera*, using manuscript names of F. Mueller. I do not think Miquel saw any specimens, and this was probably Cheel's opinion too. Cheel (1919) quoted the description in Miquel's paper and distinguished clearly between *M. halmaturorum* and *M. pustulata*, with which it had been confused, and which is, according to Curtis and Morris (1975), endemic to Tasmania. Cheel saw parts of the type collection of Heuzenroeder, but did not comment on the varieties which cannot be distinguished on the data given in Miquel's paper. Specimens obtained from the type localities of these varieties do not differ significantly from the type of *M. halmaturorum*.

10. **Melaleuca lanceolata** Otto, Horae Phys.Berol.(1820)36 (non R.Br. ex Baker, Proc.Linn.Soc.N.S.W.38(1914)601 = *M. deanii* F. Muell.); DC., Prodr.3(1828)212; Eichler, Suppl.Black's Fl.S.Austral.(1965)232; Blake, Contr.Queensl.Herb.1(1968)61.

[*Type:* From plant cultivated in Berlin Botanic Gardens (G-DC); fide Blake (1968)61.]

Fig. 9. *M. halmaturorum.* A, twig, nat. size; B, leaf, upper surface, x 5; C, leaf, lateral view, x 5; D, flower, x 5; E, stamen bundle, x 6; F, fruits, nat. size.

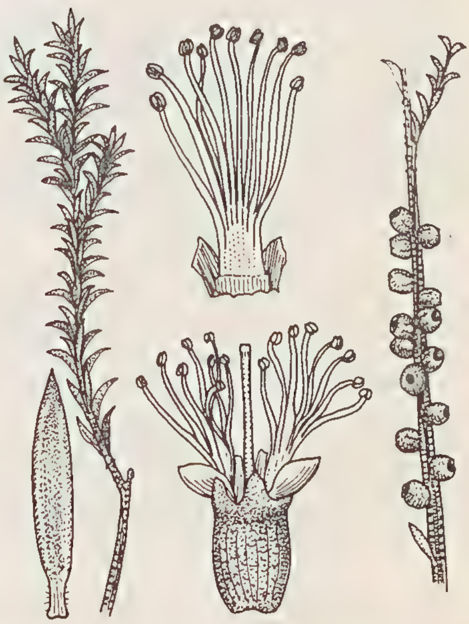


Fig. 10. *M. lanceolata.* A, twig, x ½; B, leaf, x 3, C, flower, x 4, D, stamen bundle, x 5; E, fruits, x ¾.

Melaleuca pubescens Schau., Walp.Rep.Bot.Syst.2(1843)928; Black, Fl.S.Austral.ed.1(1926)409, ed.2(1952)610, t.810; Willis; Vict.Nat.65(1948)76; Blackall & Grieve, West.Aust.Wildfl.1(1954)301, excluding the synonym. *Melaleuca parviflora* Lindl. var. *pubescens* (Schau.)Domin. Bibl.Bot. 89(1928)457. *Cajuputi pubescens* (Schau.)Skeels, U.S.Dept.Agr., Bur.Pl.Ind., Bull.242(1912)41.

[*Type:* New South Wales, Lachlan River, *Cunningham 283/1817,* K, iso.; fide Blake (1968)61.]

Melaleuca curvifolia Schldl., Linnaea 20(1847)654.

[*Type:* South Australia, Light River, *Behr s.n.,* (MEL, G); fide Blake (1968)62.]

Melaleuca parviflora [non Lindl.] sensu Tate, Fl.Extratrop.S.Austral.(1890)93, in clave, 231.

Shrub or tree to 10 m high, bark black, rough, fissured, branchlets white, young shoots more or less pubescent, sometimes branchlets and leaves retaining pubescent or villous indumentum. Leaves scattered, ascending or spreading, petiole about 1 mm long, lamina thick, flat, more or less smooth, obscurely 3-nerved, linear to linear-lanceolate, acute, 5-15 mm long, 1-3 mm broad. Flowers mostly in threes, in loose, terminal, cylindrical spikes 1-5 cm long, the rachis pubescent or almost glabrous, the apex growing out before the flowers open; calyx tube oblong-cylindrical to almost turbinate, glabrous, 2-4 mm long, about 1.5 mm diameter, lobes triangular, obtuse, semi-persistent, pubescent inside, 0.5-0.9 mm long, 0.6-0.8 mm broad; petals white, almost circular, concave, about 1.5 mm across, claw about 0.5 mm; staminal claw 1-1.5 mm long bearing 8-14 filaments 4-5 mm long in two series at the apex; style about 8 mm long. Fruit ovoid or subglobose, 4-5 mm diameter, constricted at the apex, the aperture about 1 mm across. (Fig. 10.)

Moonah honey-myrtle

Distribution: (Map 6)

Western Australia, Queensland, New South Wales, Victoria, and South Australia.

Selection of Specimens examined

NULLARBOR (3): *Black s.n.,* Ooldea Soak, 26.ix.1920. *Lothian 3657,* 20 km S of Nullarbor H.S., 18.vii.1966. *Orchard 3184,* 2 km E of Dicks Plain Tank, 6.i.1971.

GAIRDNER-TORRENS BASIN (4): *Cleland s.n.,* Chances Swamp, 3.xi.1929.

FLINDERS RANGES (5): *Callen 19,* Mt Hack, 7-10.ix.1969; *Eichler 12893,* 15 km SE of Yadininna H.S., 23.ix.1956. *Whibley 466,* 22 km E of Parachilna, 29.iii.1959.

EASTERN (6): *Cooper s.n.,* 3 km N of Martin's Well, 28.ix.1942. *Warren 50,* Pualco Pass, 31.v.1969. *Williams 7008,* Bewley Bore, 2.ix.1975.

EYRE PENINSULA (7): *Alcock 75,* Lincoln N.P., 24.xi.1964. *Carrick 4017,* Cape Wiles, 22.x.1976; *Chinnock 1659,* Redcliff, 3.ix.1974. *Gale 72,* Wedge I., -.iv.1971.

NORTHERN LOFTY (8): *Donner 1072,* Bethel, 13.v.1964. *Kraehenbuehl 52,* 4 km NE of Gladstone, 7.iii.1959. *Velleman 115,* Kulpara W, 9.ii.1976.

MURRAY (9): *Carrick 2927,* 24 km S of Swan Reach, 16.ix.1971. *Eichler 12234,* 10 km SW of Murray Bridge, 4.iii.1956. *Green 159,* Kinchina, 21.viii.1950. *Spooner 796,* Billiatt C.P., 15.vi.1970.

YORKE PENINSULA (10): *Copley 6,* 5 km W of Bute, 4.ii.1966. *Eichler 13957,* 8 km S of Corny Point, 25.ix.1957. *Weber 3738,* 3 km S of Port Julia, 2.vii.1974.

SOUTHERN LOFTY (11): *Chinnock 2438,* West Lakes, 31.viii.1975. *Hunt 2773,* Milang, 12.ii.1967. *Spooner 355, 568,* Torrens Gorge, 25.vi.1969.

KANGAROO ISLAND (12): *Black s.n.,* Antechamber Bay, 16.v.1884. *Haegi 417,* 7 km NW of Kingscote, 12.iv.1973. *Mrongovius 30,* Eleanor River bridge, 1.vi.1972.

SOUTHERN EASTERN (13): *Green 282,* Kingston, 26.viii.1950. *Hunt 423,* Bool Lagoon drain, 18.xi.1961. *Orchard 1027,* Mt Rescue N.P., 8.viii.1968.

Comments:

For a discussion of the rather involved synonymy see Blake (1968). The data and distribution given by Tate (1890) for *"M. parviflora"* are more appropriate to *M. lanceolata,* except for "fruits immersed in the axis" which must be an error, because South Australian species with such fruits do not match the rest of the data and are accounted for in the remainder of the key.

Bentham (1867) places *M. lanceolata* in synonymy with *M. genistifolia* Sm. and places *M. pubescens* Schau. in synonymy under *M. preissiana* Schau.; Blackall & Grieve (1954) place *M. preissiana* in synonymy under *M. pubescens. M. pubescens* is a synonym of *M. lanceolata,* a tree with dark fissured bark. *M. preissiana* is a paper-bark, restricted in distribution to the south-west of Western Australia.

M. lanceolata is a widespread species showing some variation in leaves and fruit, particularly in size. The leaves sometimes show a tendency to become thicker and somewhat terete, suggestive of hybridization with *M. pauperiflora* or adaptation to particular habitats. The fruits in some specimens are larger than the average and have a much wider aperture. The species merits a thorough taxonomic and autecological investigation.

[The denser flower-head and thinner-walled fruit with more open aperture can often be used to distinguish *M. pauperiflora* when plants vegetatively intermediate are encountered.]

11. **Melaleuca leiocarpa** F. Muell., Fragm.10(1876)55; Blackall & Grieve, West.Austral.Wildfl.1(1954)299, in clave; Eichler, Suppl.Black's Fl.S.Austral.(1965)233.

[*Type:* Western Australia "prope montem Churchmanii", *Young s.n.* (MEL).]

Shrub or tall shrub, 1-3 m high, glabrous except the inflorescence, branchlets rigid, ascending, bark greyish becoming black, fissured. Leaves scattered, appearing distichous because of the twisted flat 1.5 mm petioles, stiff, thick, flat, linear-lanceolate or linear-oblong, abruptly narrowed at both ends, the apex produced in a small pungent mucro, both surfaces smooth or glands more or less prominent, central and marginal veins obscure, 7-15 mm long, 2-3 mm broad. Spikes few-flowered, terminal, sometimes one or two lateral spikes at the base of the terminal one, the apices soon growing out, rachis pubescent; bracts stiff, pubescent particularly at the broad base outside, glabrous inside, ovate, obtuse, about 4 mm long and 2 mm broad, concave, caducous; calyx pubescent particularly towards the base, or almost glabrous, tube cup-shaped, about 3 mm long and broad, lobes triangular-ovate, obtuse, about 1.5 mm long; petals white, almost semicircular, broadly rounded at the apex, truncate at the base, slightly concave, about 2 mm long, 2.5 mm broad at the base, claw narrow, scarcely 1 mm long; stamens yellow, claw about 2 mm long, bearing 10-16 filaments 4-6 mm long in two rows at the apex; anthers about 1 mm long; style about 10 mm long; expanded at the apex, more or less convex on top with a central depression, the stigma situated on the rim. Fruit smooth, truncate-ovate, rounded at the base, slightly constricted at the apex, about 5 mm long and 6.5-8 mm diameter, rim thick, aperture about 3 mm across. (Fig. 11.)

Pungent honey-myrtle

Distribution (Map 7)

Western Australia and South Australia.

Specimens examined

South Australia

GAIRDNER-TORRENS BASIN (4): *Reid s.n.*, Lake Everard H.S., 30.ix.1966. [*Culic s.n.*, 33 km NNE of Kalanbi, s.d. (Herb. Ecological Survey of S.A.).]

EYRE PENINSULA (7): *Chinnock 2936*, 23 km NE of Poochera, 20.x.1975. *Lay 115*, 25 km N of Ceduna, 30.x.1970. *Reid s.n.*, N of Childara Rock-hole, 31.iii.1960. *Symon 8190D*, 19 km WSW of Yardea H.S., 6.x.1972.

Western Australia

Koch 1604, Watheroo, rabbit fence, -.ix.1905; *P.G. Wilson 3507*, 9 km E of Southern Cross, 22.ix.1964.

Comments:

The type collection, found among unincorporated material at MEL, did not have flowers. The flowering specimens examined do not differ from the type, but do differ from Mueller's description, in that the length of the staminal claw is much shorter than the petal.

Fig. 11 *M. leiocarpa.* A, twig, slightly reduced; B, leaf, lower surface, x 3; C, flower, x 4; D, stamen bundle, x 5; E, fruits, x ¾.

Fig. 12 *M. linariifolia.* A, twig, x ¾; B, leaf, lower surface, x 2; C, flower, x 4; D, stamen bundle, x 5; E, fruits, nat. size.

12. **Melaleuca linariifolia** Sm., Trans.Linn.Soc.3(25 May, 1797,)278; Willd., Sp.pl.3(1802)1432; Sm., Exot.Bot.1(1804)109, t.56; DC., Prodr.3(1828)214; Benth., Fl.Austral.3(1867)140; F. Muell., Fragm.10(1876)55; Bailey, Queensl.Fl.2(1900)599; Beadle, Evans & Carolin, Hdbk.Syd.(1963)294; Eichler, Suppl. Black's Fl.S. Austral.(1965)233.

[*Type:* Cultivated in Cambridge, England, originally from "Port Jackson", New South Wales.]

Metrosideros hyssopifolia Cav., Icon.4(Sept.-Dec.1797)20. t.336.

[*Type:* New South Wales, "prope Jackson oppidum".]

Melaleuca stricta Hort.ex Dum.Cours., Bot.cult.ed.2, 5(1811)375, vide Jackson, Ind.Kew.2(1895)188.

Melaleuca trichostachya [non Lindl.] sensu Tate, Fl.Extratrop.S.Austral.(1890)92, in clave, 231.

Tree to 10 m high, bark thick, spongy, branches slender, almost smooth. Leaves slightly pubescent when young, mostly opposite, sessile, linear-lanceolate, tapering, acute, 1-3-veined, midvein more prominent on lower surface, concave, often keeled, usually closely gland-dotted on both surfaces, 15-25 mm long, 1-2 mm broad. Spikes more or less oblong, terminal and on short lateral branches, the apex soon growing out, rachis pubescent; bract ovate acuminate-acute, concave, hairy outside and in, margin ciliate in the lower half, 2.5 mm long, 2 mm broad near the base; bracteoles ovate, hairy outside and in, margin ciliate, about 1 mm long and not quite so broad; calyx glabrous, tube hemispherical, about 1.5 mm long, lobes deltoid-ovate, about 1 mm long and 1 mm broad at the base; petals white, sessile, circular, about 3 mm across, concave; stamens white, claw narrow, tapering, 6-7 mm long, bearing 30-60 filaments 1-2 mm long pinnately from near the base to the apex, anthers very small, about 0.2 mm long; style about 8 mm long. Fruit hemispherical, base rounded, apex truncate, not constricted, 2 mm long, 3 mm diameter, valves slightly exserted. (Fig. 12.)

Narrow-leaved honey-myrtle

Distribution (Map 7)

Northern Territory, Queensland, New South Wales and South Australia.

Specimens examined

South Australia

LAKE EYRE BASIN (2): *Boomsma s.n.*, Callamurra W.H., 19.xi.1975. *Cleland*, Coopers Creek, 29.v.1924. *MacGillivray s.n.*, Coopers Creek, -.x.1920. *Johnson s.n.*, Dig Tree, 17.vi.1972. *Symon 5835*, Dig Tree, 19.viii.1968.

Northern Territory

Willis s.n., Palm Valley, 16.ix.1965. *Forde 689*, Standley Chasm, 3.xi.1956. *Cleland s.n.*, Finke Gorge, 17.viii.1929.

Queensland

Carrick 1924, Nappa Merrie, 20.viii.1968. *Jackson 427*, Nappa Merrie, 12.viii.1962. *Adams 1319*. 24 km N of Alpha, 24.ix.1964. *Story & Yapp, 340*, 31 km S of Rolleston, 14.x.1962.

New South Wales

Boorman s.n., Wyong, -.xi.1916. *Cleland s.n.*, Rydalmere, 12.xi.1909. *s.n.*, Ourimbah, -.xi.1911; *s.n.*, Dungog, 7.xi.1916.

Comments:

Melaleuca alternifolia (Maiden & Betche) Cheel (1924), originally regarded as a variety of *M. linariifolia* by Maiden & Betche (1904), is distinct [but does not occur in South Australia]. The relationship between *M. linariifolia* Sm. and *M. trichostachya* Lindl. is not clear.

Smith (1797, 1804) described *M. linariifolia* as follows, from material collected at Port Jackson, introduced into England in 1793, and cultivated at Cambridge, see Donn (1845) and Cheel (1922): large tree, bark thick and spongy, branches round or slightly angular, smooth; leaves opposite (however, the accompanying plate (1804) shows the leaves alternate or scattered, or at most sub-opposite), linear-lanceolate, acute, not pungent, smooth above, multi-spotted below, 3-nerved; flowering branchlets terminal, loose, the apex growing out, flowers solitary, opposite, sessile, white; filaments very long, pinnate, produced from near the base to the summit; fruit smooth, hemispherical.

Lindley (1848) described *M. trichostachya* as follows, from material collected on the Belyando River during Mitchell's 1846 expedition: leaves more often opposite, linear, flat, very acute at both ends; spikes terminal, rather lax, rachis pilose, calyx glabrous, lobes herbaceous; staminal bundles with many anthers, the claw shorter than the petals.

Bentham (1867) reduced *M. trichostachya* to varietal rank under *M. linariifolia*, citing the following differences: leaves usually smaller flowers smaller in loose spikes, bracts very narrow, stamens more crowded on a shorter claw, fruiting calyx more open. Within the variety he included collections from Coopers Creek.

Mueller (1889) retained *M. trichostachya;* Bailey (1900, 1913) followed Bentham in placing it within *M. linariifolia.*

Baker & Smith (1906, 1910), in their investigations of the essential oils in *Melaleuca*, were able to distinguish chemically between the two taxa and on this basis, as well as morphological and anatomical data, regarded *M. trichostachya* as of specific status, giving it a very wide distribution "from the moist coast region to the arid interior (Coopers Creek) and yet constant in character throughout."

Cheel (1922) disagreed with Baker & Smith regarding identification of some collections, placing them in *M. linariifolia.* Apparently, neither Cheel nor Baker & Smith examined specimens from Central Australia, quoting Bentham from Coopers Creek and Mueller from South Australia and North Australia.

From the various descriptions, two characters appear to be distinctive: staminal claws long with pinnate filaments, and bracts broad (by inference!) for *M. linariifolia;* staminal columns short with crowded filaments, and bracts very narrow for *M. trichostachya.* Central Australian collections held at AD are from south-western Queensland, southern Northern Territory and north-eastern South Australia (including Coopers Creek). These are smaller in leaf size compared with coastal collections, but little different in flower size or inflorescence. However, they do have long staminal claws with pinnate filaments, and broad bracts. Until critical examination of a wide range of specimens elucidates the relationships between *M. linariifolia* Sm. and *M. trichostachya* Lindl., the South Australian specimens are more appropriately placed in the former.

13. **Melaleuca nanophylla** Carrick, sp. nov.

Typus: N.N. Donner 3894, "ca. 35 km west of Emu, approx. 28° 33'S 130° 54' E", 16.vii.1972 (AD, holotypus; isotypi: CANB, MEL, PERTH, K, E, B, NY, A-GH, L).

Arbor parva, ad 5 m alta; ramuli glabri, albi, tenuissimi, brevissimi, copiosissimi, excavati; rami atrocinerei, cortice aspero plus minusve fissurato, *Folia* conferta, spiraliter disposita, glabra, laevia, sessilia, ad basin lateraliter affixa, amplectentia, decidua, late obovata, base truncata, apice late rotundata vel obtusa interdum acuta, infera convexa saepe carinata, supra crista crassa hippocrepiformi, obscure trinervia, gladulis inconspicuis, plerumque minus quam 1.5 mm longa et 1 mm lata. *Flores* 1-3 in axillis foliorum, rhachidi pubescenti, bracteis bracteolisque minutis, pubescentibus, ovato-acuminatis, minus quam 1 mm longis 0.5 mm latisque; *calyx* tubo cyathiformi, glabro, laevi, circa 1 mm longo, lobis glabris, late ovatis vel semicircularibus, marginibus scariosis, obscure nervosis, circa 0.5 mm longis, vix 1 mm latis; *corolla* albida, glabra, petalis oblongis, concavis, ad basin truncatis, marginibus plus minusve ciliatis, circa 1.5 mm longis, 1 mm latis, unguis perbrevibus; *stamina* flavida, ungue circa 2.5 mm longa, 6-12 filamentis 1-2 mm longis apicem versus in seriebus duobus; *stylus* circa 4 mm longus, ad apicem non expansus, stigma fere plana. *Fructus* subglobosus, circa 2 mm diam apice vix constrictus, albidus, decorticatus, calycis loborum vestigiis lignosis coronatus.

Small tree 3-5 m high, branchlets short and very numerous, glabrous, densely clothed with very deciduous leaves particularly on drying, eventually only a few remaining at the apices, leaving a very slender white stem excavated where the leaves were attached, branches dark grey, bark rough, more or less fissured. Leaves spiral, crowded, glabrous, smooth, sessile, attached laterally at the base which clasps the stem, broadly ovate, base truncate, apex broadly rounded or obtuse sometimes acute, lower surface convex, often ridged, upper surface with a thick horseshoe-shaped ridge above the oblong point of attachment, obscurely 3-veined, glands not conspicuous, less than 1.5 mm long and 1 mm broad. Flowers 1-3 in the axils, in short spikes, rachis pubescent, bracts and bracteoles minute, pubescent, ovate-acuminate, less than 1 mm long and 0.5 mm broad; calyx tube cup-shaped, glabrous, smooth, about 1 mm long, lobes broadly ovate or simicircular, apex short, obtuse, border narrow, scarious, about 0.5 mm long, almost 1 mm broad at base, obscurely veined; corolla whitish, petals concave, oblong, truncate at base, margin more or less ciliate, about 1.5 mm long, 1 mm broad, claw very short; stamens pale yellow, claw about 2.5 mm long, bearing 6-12 filaments 1-2 mm long in two series at the apex; style about 4 mm long, not expanded at the apex, stigma almost flat. Fruit almost spherical, about 2 mm diameter, crowned by the woody bases of the calyx lobes scarcely constricted at the apex, the outer tissues whitish, thin, papery, peeling. (Fig. 13.)

Dwarf-leaved honey-myrtle

Distribution (Map 7)

Endemic to South Australia.

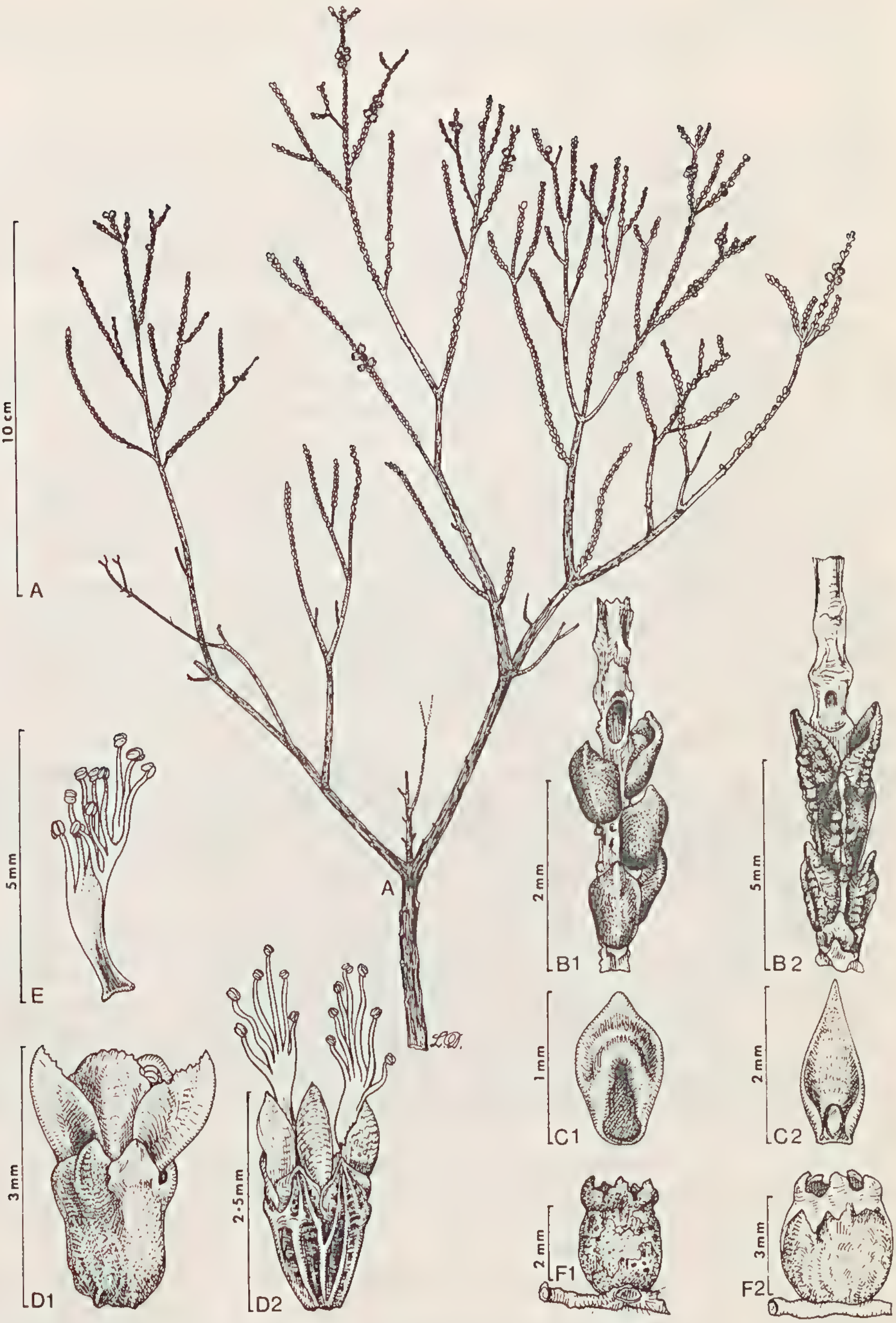


Fig. 13. *M. nanophylla*. A, twig; B1, leaves; C1, leaf, upper surface; Di, flower; E, stamen bundle; F1, fruit. *M. minutifolia*. B2, leaves; C2, leaf, upper surface; D2, flower; F2, fruit.

Specimens examined

NORTH-WESTERN (1): *Donner 3894*, 35 km W of Emu, 16.vii.1972. *Forde s.n.*, 32 km W of Emu, 3.ix.1956. *Lothian 3915*, 35 km W of Emu, 31.v.1967; *5623*, *5624*, 32 km W of Emu, 17.vii.1972; *5665*, 40 km S of Vokes Hill, 19.vii.1972. *Reid s.n.*, Spanners Highway, 24.vi.1967; *s.n.*, 24 km N of Emu, 25.vi.1967; *s.n.*, 32 km W of Emu, 25.vi.1967. *Walker s.n.*, Emu-Maralinga area, -.ix.1968.

Comments:

Bentham (1867) regarded his arrangement as artificial and in consequence some species were distantly removed from those which may be more closely related. The affinities of *Melaleuca nanophylla* can be assessed only in a revision of the genus when investigation of the taxonomic significance of the various characters elucidates the relationships between species. According to Bentham's grouping, *M. nanophylla* fits into his series Peltatae, containing a number of species with which it may be confused. The distinctive characters are given below.

There are two Western Australian species, both from the South Western Province. 1. *M. micromera* Schau. (1844) differs in having: leaves in whorls of three, mostly less than 1 mm long, with a thick, circular or horse-shoe-shaped ridge on the lower surface; branchlets pubescent, as are also the leaf-excavations; fruits shallowly cup-shaped, 1.5-2 mm long, 2.5-3 mm diameter at the expanded thickened margin which carries the persistent woody calyx lobes surrounding the persistent style. 2. *M. thyoides* Turcz. (1847) differs in having: pubescent branchlets with glabrous leaf-excavations; closely appressed, broadly ovate, ciliolate leaves only 0.5 mm long and slightly broader; fruits more or less compacted.

There are two Queensland species, from Leichhardt District and Cape York Peninsula respectively. 1. *M. tamariscina* Hook. (1848) differs in having: closely appressed, concave leaves with ciliolate margins, mostly 0.5 mm long, seldom 1 mm; closely clustered fruits 3-4 mm diameter, very constricted at the apex the aperture 1-1.5 mm across. 2. *M. foliolosa* A. Cunn. ex Benth. (1867) differs in having: pilose branchlets with glabrous leaf-excavations; closely appressed, more or less diamond-shaped leaves with ciliolate margins, central attachment and acute base and apex; subglobose fruits about 3.5 mm diameter, constricted at the apex, the aperture 2.5 mm across.

M. minutifolia F. Meull. (1859) has a wider distribution than the others, extending from the King Leopold Ranges of Western Australia, through the Katherine district of Northern Territory, to the Flinders River in Queensland, and this name has been applied on herbarium sheets to the new species. It differs in having: decussate, concave, acuminate-acute leaves, 3-5-veined, 1.5-3.5 mm long; strongly ribbed calyx tube when young; fruits larger, about 3 mm diameter. (fig. 13.)

The following rearrangement of series Peltatae in Bentham's key accommodates the new species. Excavation of the branchlets is a character too indecisive for primary subdivision, and several important characters, such as length of staminal claw and number of stamens, are incompletely known. Turczaninow's original description of the disposition of the leaves as "decussate" in *M. thyoides* is an understandable error because of the very crowded overlapping arrangement. Bentham (1867) and Blackall & Grieve (1959) correctly use the term "spiral". There is also some variation in *M. thyoides*, a species not easy to differentiate from *M. tamariscina*,

Peltatae — leaves very small, often scale-like, more or less peltately attached. Flowers small, in heads or spikes, usually dense.

1. Leaves in whorls of 3, or decussate .... 2.
   Leaves spirally or irregularly arranged .... 5.
2. Leaves in whorls of 3; flowers strictly dioecious; stamens few in each bundle .... 95. *M. micromera*
   Leaves decussate .... 3.
3. Branchlets hairy; flowers few in heads; stamens numerous in each bundle .... 94. *M. foliolosa*
   Branchlets glabrous .... 4.

4. Leaves obtuse, spreading, 2-4 mm long .... 92. *M. deltoidea*
   Leaves pointed, erect, usually less than 2 mm long .... 93. *M. minutifolia.*
5. Upper surface of leaf with a horse-shoe-shaped ridge, margin not ciliolate; spikes few-flowered .... 98. *M. nanophylla*
   Upper surface of leaf concave, margin ciliolate .... 6.
6. Spikes more or less dense; fruiting spikes ovoid-globular or shortly oblong, often compact.. 96. *M. thyoides*

   Fruiting spikes oblong-cylindrical, sometimes more or less loose .... 97. *M. tamariscina.*

14. **Melaleuca neglecta** Ewart & Wood, Proc.R.Soc.Vict.n.s.23(1910)60, t.13, f.1, 2, 4; Black, Fl.S.Austral.ed.2(1952)612, t.815; Willis, Hdbk.Pl.Vict.2(1972)455.

[*Type:* Victoria, near Bimboola, *St. Eloy D'Alton s.n.*]

Melaleuca ericifolia [non Sm.] sensu Tate, Hdbk Fl.Extratrop.S.Austral.(1890)93 in clave, 231.

Melaleuca fasciculiflora [non Benth.] sensu Black, Fl.S.Austral.ed.1(1926)410.

Melaleuca oraria Black, Trans.R.Soc.S.Austral.69(1945)309; Black, Fl.S.Austral.ed.2(1952)612, t.814.

[*Type:* South Australia, Beachport, *Black s.n.* (AD 97632082, lecto., hic Carrickio designatus).]

Tall shrub 2-3 m high, bark dark, rough, corky, fissured, branchlets white, long and slender, more or less erect. Leaves scattered or almost in whorls of 3, crowded on the branchlets, erect or ascending, narrowly linear-lanceolate, obtuse, apex slightly incurved, plano-convex, two rows of prominent glands on lower surface, 4-8 mm long, about 1 mm broad, petiole almost 1 mm long. Flowers in short axillary spikes on the previous year's branches, forming long dense or interrupted inflorescences, rachis glabrous; bract depressed ovate, concave, glabrous, semi-persistent, about 1 mm long, 1.5 mm broad; bracteole ovate, margin ciliate, about 1 mm long, 0.5 mm broad; calyx glabrous outside, cup-shaped, tube 2.5 mm long, lobes triangular acute, about 1 mm long and 1 mm broad at the base, hairy inside; petals white, broadly ovate-oval, apex rounded, entire or more or less laciniate, about 2 mm long and broad, concave; stamens pale cream, claw about 1.5 mm long, bearing 8-16 filaments 2-4 mm long in two rows at the apex; style about 6 mm long, slightly expanded at the apex, stigma a ring around the central depression. Fruit rough, corky, fissured, more or less cylindrical, base rounded, apex truncate, 3-4 mm long, 4-5 mm diameter, rim very thick, aperture about 2.5 mm across. (Fig. 14.)

Fig. 14. *M. neglecta.* A, twig, x 2/3; B, leaf, lower surface, x 4; C, leaf, lateral view, x 4; D, flower, x 4; E, stamen bundle, x 5; F, fruits, nat. size.

Mallee honey-myrtle, D'Alton's melaleuca

Distribution (Map 8)

Victoria and South Australia.

Selection of Specimens examined

EYRE PENINSULA (7): *Alcock s.n.,* Pillana, -.x.1963; *1672,* Whites Flat, 26.x.1967; *2521,* N Gawler Pond, 24.x.1968. *Cleland s.n.,* Tod River reservoir, 7.xii.1959. *Jackson 1201,* 15 km SSE Bascombe Well H.S., 7.x.1967. *Newman s.n.,* Streaky Bay, 23.viii.1959. *Specht 2658, 2659,* Lincoln N.P., 10.xi.1960. *Swaby s.n.,* Coffin Bay, 27.iv.1969. *Symon s.n.,* Koppio School, 12.xi.1960. *Williams 5901,* Charleton Gully swamp, s.d.

NORTHERN LOFTY (8): *Cleland s.n.,* Light River, 27.iv.1968. *Kuchel 1137,* Tarlee, 26.viii.1963.

MURRAY (9): *Cleland s.n.,* Mannum, 13.iv.1924. *Newman s.n.,* Harrison Creek, 23.vii.1960. *Spooner 1254,* Caloote, 15.v.1971.

SOUTHERN LOFTY (11): *Eichler 14544,* Yankalilla River, 19.xi.1957. *Kraehenbuehl 248,* Goolwa to Tooperang, 19.xi.1960. *Spooner 206,* Windsor Gardens, -.iii.1968; *2775,* Noarlunga, 15.iv.1973; *4317,* Delamore, 1.xi.1975.

KANGAROO ISLAND (12): *Crisp 368,* Sapphiretown, 25.viii.1971. *Eichler 15180,* 3 km W of Kellys Hill, 4.xi.1958. *Jackson 889,* Stunsail Boom River, 28.xi.1971. *Wilson 823,* Hanson Bay, 9.xi.1958.

SOUTH-EASTERN (13): *Alcock 3195,* Big Heath N.P., 18.xi.1969. *Beauglehole 5938,* Yallum, 15.xii.1963. *Carrick 2502,* Currawong H.S., 19.x.1969. *Hunt 374,* 10 km W of Naracoorte, 11.xi.1961. *Symon 8377,* 17 km SE of Keith, 10.xi.1972.

Comments

[Willis (1972) is followed in treating *M. neglecta* and *M. oraria* as synonymous.]

15. **Melaleuca oxyphylla** Carrick, sp. nov.

Typus: D.E. Symon 8091A, "Gawler Ranges, hills 21 km SW of Yardea", 2.x.1972, (ADW, holotypus; isotypi: AD, CANB, NSW, K).

Frutex ad 2 m altus, innovationes pubescentes, ramuli virgati, adscendentes, albidi, rami cinerei, leviter fissurati. *Folia* decussata, conferta, glabra, recta vel adscendentia, imbricata, floralia patentia, petiolo circa 1 mm longo, lamina lineari-lanceolata, acuminata, acuta, fere plana aut apicem versus incurvata vel recurvata, margine crassa, infera glandulosopunctata, 8-12 mm longa, 1-1.5 mm lata. *Flores* 2-5, in spicas perbreves axillares, rhachide glabra, pedunculis aliquot bracteis membranaceis imbricatis lanatis subtentibus, bracteolis ut videtur nullis, in inflorescentiis laxis 5-15 cm longis dispositus; *càlyx* tubo fere glabro, cyathiformi, circa 2.5 mm longo latoque, lobis deltoideis, circa 1 mm longis latisque, extus pubescentibus, intus glabris, margine scariosa; *corolla* albida, glabra, petalis fere circularibus, concavis, circa 2.5 mm latis, unguibus perbrevibus; *stamina* luteola, ungue circa 2-3 mm longa, 9-15 filamentis 2-3 mm longis apicem versus pinnatis; *stylus* circa 4 mm longus, ad apicem vix expansus, stigma convexa. *Fructus* subglobosus, circa 3.5 mm longus, 4 mm diam., ad apicem constrictus, apertura 1-1.5 mm diam.

Shrub 1-2 m high, very young shoots pubescent; branchlets long, slender, ascending, whitish; branches grey, slightly fissured. Leaves decussate, crowded, erect or ascending, more or less patent in flower, glabrous, petiole about 1 mm long, lamina linear-lanceolate, acuminate-acute, almost flat or with the upper part incurved or recurved, margin thickened, glandular-punctate below, 8-12 mm long, 1-1.5 mm broad. Flowers 2-5, in very short axillary spikes, rachis glabrous, peduncles subtended by a few woolly, imbricate, membranous bracts, bracteoles apparently absent, forming loose inflorescences 5-15 cm long; calyx tube almost glabrous, cup-shaped, about 2.5 mm long and broad, lobes deltoid, about 1 mm long and broad, pubescent outside, glabrous inside, margin scarious, semipersistent on young fruits; corolla whitish, glabrous, petals almost circular, concave, about 2.5 mm across, claw very short; stamens yellowish, claw about 2-3 mm long bearing 9-15 filaments 2-3 mm long pinnately on the upper part; style about 4 mm long, slightly expanded at the apex, stigma convex. Fruits smooth, almost spherical, about 3.5 mm long, 4 mm diameter, constricted at the apex, aperture 1-1.5 mm across, borne in scattered clusters on the old wood. (Fig. 15.)

Fig. 15. *M. oxyphylla.* A, twig; B, leaves; C, flower; D, stamen bundle; E, fruits.

Pointed-leaved honey-myrtle

Distribution (Map 8)

Endemic to South Australia.

Specimens examined.

EYRE PENINSULA (7): *Copley 2777*, 25 km E of Kimba, 3.viii.1969. *Hill 645*, 37 km Kimba to Cowell, 10.xi.1957. [*Lang 1236*, near Corrobinnie Hill, 16.ii.1978.] *Leiblich s.n.*, Darke Peak, 16.xi.1969. *Orchard 2284, 2292*, 35 km N of Minnipa, 26.ix.1969. *Rohrlach 277*, 10 km SSW of Kimba, 11.iv.1959; *683*, 30 km NW of Kimba, 13.x.1959; *689*, 24 km W of Kimba, 18.x.1959. *Spooner 2495*, Scrubby Peak, 8.ix.1972. *Symon 8091A*, 21 km SW of Yardea, 2.x.1972. [*Williams 9142*, 38 km W of Kyancutta, 17.ii.1977 (Herb. Ecological Survey of S.A.).] *Wilson 200*, 22 km SSE of Kimba, 4.x.1958.

Comments

M. oxyphylla fits into series Decussatae of Bentham (1876), who notes: "The opposite-leaved species of the series Spiciflorae differ in the dense, many-flowered spikes and those of the Capitatae in the flowers, whether in heads or solitary, being always at the ends of the branches at the time of expanding."

The new species approaches close to *M. acuminata* F. Muell. but differs in the generally longer narrower leaves [and in the shorter staminal column].

16. **Melaleuca pauperiflora** F. Muell., Fragm.3(1862)116; Benth., Fl.Austral.3(1867)161; Diels & Pritzel, Bot.Jahrb.Syst.35(1905)429; Cheel, Trans.R.Soc.S.Austral.43(1919)370, t.38; Black Fl.S.Austral.ed.1(1926)411, t.39, f.5-9; ed.2(1952)612, t.816; Blackall & Grieve, West.Austral.Wildfl.1(1954)300, in clave.

[*Type:* Western Australia, "in montibus Phillips Range", *Maxwell s.n.*]

Melaleuca sheathiana Fitzg., J. Proc. Muell.Bot.Soc.W.Austral.1/9(1902)16; Blackall & Grieve, West. Austral. Wildfl.1(1959)300, in clave.

[*Type:* Western Australia, Lakeside and Black Flag, *Fitzgerald s.n.*]

Intricately branched shrub to 3 m high; young shoots often pubescent, branchlets white, branches dark grey, bark loose and papery. Leaves scattered, ascending or spreading, glabrous, petiole flat, about 1 mm long, lamina linear, nerveless, apparently smooth, thick, semi-terete or almost terete, 4-12 mm long, about 1 mm broad, apex broadly rounded, often almost hemispherical, usually with a small hard tooth-like point at the apex towards the lower surface. Vegetative and flowering buds enclosed in several series of closely overlapping scales, of which the upper are larger, scales ovate, caducous leaving scars on the branchlets. Inflorescence a condensed head-like spike of 3-6 flowers, terminal, often with several axillary spikes formed around the terminal one, the axes growing out after flowering; calyx tube glabrous, ovoid, about 2 mm long, 1.5 mm broad, lobes deltoid, about 1 mm long, 1 mm broad at the base, with scarious margins; petals 2 mm long, white; stamens white, claws shorter than the petals, bearing 7-15 about 2.5-3.5 mm long filaments in two rows at their apex. Style about 4 mm long. Fruit globular, 4-5 mm diameter, in small clusters, not sunk in the rachis, orifice about 1-2 mm diameter. (Fig. 16.)

Distribution (Map 9)

Western Australia and South Australia.

Selection of Specimens examined

LAKE EYRE BASIN (2): *Boomsma s.n.*, ca. 100 km N of Tarcoola, 24.ix.1974; *3*, Lake Phillipson, 25.ix.1974.

NULLARBOR (3): *Pastoral Board s.n.*, Mulgathing, 26.ix.1960.

GAIRDNER-TORRENS BASIN (4): *Cleland s.n.*, ca. 25 km N of Wilgena Station, 26.xi.1925. *Forde 723*, Lake Windabout, 1.iii.1957. *Lay 170*, NE of Malbooma, 25.xi.1970. *Lothian 2670*, Arcoona Station, 1.v.1964. *Murray s.n.*, Yeltacowie, 3.vi.1927; 8.viii.1927. *Taylor s.n.*, Wallabyng, May, 1919. *Weber 1454*, Andamooka Station, 9.ix.1968.

EYRE PENINSULA (7): *Aitken M3,* W of Penong, April, 1973. *Alcock s.n.,* ca. 12 km SW of Kimba, November, 1963. *Black s.n.,* Minnipa, 11.xi.1915; *s.n.,* Poochera, October, 1942. *Canning 023594,* Ceduna, 1.ix.1968. *Ising s.n.,* Arno Bay, 26.viii.1935. *Rohrlach 114,* Pinkawillinie; *567,* Caralue Bluff, 20.ix.1959. *Wheeler 852,* Hincks N.P., 7.x.1968. *Whibley 409,* S of Buckleboo, 19.x.1958. *Wilson 1606,* ca. 6 km NW of Fowlers Bay, 12.ix.1960.

NORTHERN LOFTY (8): *Donner 1864,* Port Wakefield, 12.x.1966. *Lothian 1505,* ca. 9 miles (14 km) S of Port Wakefield 23.x.1955.

MURRAY (9): *Cleland s.n.,* Mantung, 18.viii.1924. *Spooner 4677,* Karoonda, 19.vi.1976. *Wilson 41,* Chauncey's Line, 23.ix.1958.

YORKE PENINSULA (10): *Cooper s.n.,* near Port Broughton, 12.x.1954. *Tepper 159,* Ardrossan, September, 1879. *Weber 3853,* 1 km S of Port Julia, 21.viii.1974.

SOUTHERN LOFTY (11): *Black s.n.,* Dublin, 15.ix.1907.

Black (1926) made no mention of *M. sheathiana,* but later (1952) listed it as a synonym of *M pauperiflora.* Blackall & Grieve (1959) retained them as distinct species. Two questions arise: are these two distinct species and, if so, to which do the South Australian plants belong?

Mueller described *M. pauperiflora* in 1862 from Western Australia, and Bentham (1867) provided some additional data. Fitzgerald (1902) listed the chief differences between his new species *M. sheathiana* (also from Western Australia), and *M. pauperiflora* as being: foliage (leaves shorter) hirsute calyx tube, few ovules and size and shape of fruiting calyx (urceolate, 2-2.5 x 2 mm, immersed).

Cheel (1919) surveyed the relationships between the two species and quoted a note by Fitzgerald on the type sheet: "After an examination of numerous specimens of *M. pauperiflora* F.v.M., including the type, I am convinced that *M. sheathiana* cannot be maintained as a distinct species". Cheel, however, concluded that the extreme forms were so distinct that it may be advisable to regard the smaller-leaved forms as a variety of *M. pauperiflora.*

Fig. 16. *M. pauperiflora.* A, twig, x ½; B, leaf, x 2½; C, flower, x 6; D, stamen bundle, x 10; E, fruits, x ¾.

Fig. 17. *M. rhaphiophylla.* A, twig, x ½; B, leaf, x 2; C, flower, x 4; D, stamen bundle, x 5; E, fruits, x 2/3.

[Carrick considered it likely that two subspecies should be recognized in South Australia: one from the southern districts, and a new subspecies from the Lake Eyre, Nullarbor, Gairdner-Torrens and Flinders regions and one specimen from the Murray at Mantung. He did not record the characters on which these would be separated, but superficially the proposed new subspecies has paler more yellowish broader and shorter and slightly arcuate leaves and whiter fruits. A thorough study of the species over its whole range is needed to evaluate this proposal. Further work is also needed on the differences between *M. pauperiflora* and *M. lanceolata.*]

17. **Melaleuca rhaphiophylla** Schau. in Lehm., Pl.Preiss.1(1844)143; Benth., Fl.Austral.3(1867)147; Blackall & Grieve, West.Austral.Wildfl.1(1954)302; Eichler, Suppl.Black's Fl.S.Austral.(1965)234.

[*Types:* Western Australia, Swan River above Perth, *Preiss 264;* Avon River near York, *Preiss 267.*]

Melaleuca hamulosa [non Turcz.] sensu Ising, Trans.R.Soc.S.Austral.81(1958)168.

Tall shrub or small tree to 5 m high (in South Australia), glabrous except the very young pubescent shoots, branchlets whitish, branches pale grey, bark stripping off in papery sheets. Leaves scattered, ascending or almost patent, narrow-linear, somewhat plano-convex, straight or recurved in the upper part particularly when young, cuneate into a 1 mm petiole, acute with a short, soft, straight or recurved mucro, glands on the lower surface conspicuous when young, 1-2 cm long, 0.5-1 mm broad. Inflorescence a cylindrical spike, the axis growing out before anthesis, rachis glabrous; calyx tube closely sessile, more or less cylindrical, expanded and truncate at the base, glabrous, about 1.5 mm long, 2.5 mm diameter, lobes triangular-ovate, acute, margin scarious, glabrous outside and in, about 0.5 mm long, 1 mm broad; corolla white, petals circular, concave, glabrous, about 2.5 mm across, claw very short; stamens whitish, claw 4-5 mm long bearing 15-20 filaments 2-3 mm long pinnately in two series towards the apex; style about 6 mm long, scarcely expanded at the apex, stigma almost flat. Fruits close together, not compacted, partially embedded in the axis, subcylindric, about 2.5 mm long, 4-6 mm diameter, constricted at the apex, aperture about 2 mm across. (Fig. 17.)

Needle-leaved honey-myrtle

Distribution (Map 10)

Western Australia and South Australia.

Specimens examined

EYRE PENINSULA (7): *Blaylock 1904,* 3 km N of Hiltaba H.S., 4.ix.1972; *1924,* ibid., 5.ix.1972. *Chinnock 2956,* Mt Yardea, 21.x.1975. *Copley 2081,* 7 km W of Yardea H.S., 31,viii.1968. *Cornwall 26,* Carapee Hill, 20.vi.1967. *Crisp 782, 790,* Carapee Hill, 18.v.1974. *Donner 3145,* 40 km NNE of Minnipa, 27.x.1968. *Gardiner s.n.,* N shore Lake Gairdner, 12.x.1969. *Haegi 751,* 50 km from Minnipa towards Yardea, 17.x.1975. *Ising s.n.,* Wudinna Hill, 1.ix.1935, 7.ix.1928, 29.ix.1939; *s.n.,* Gawler Ranges, 13.ix.1938, 2.xi.1939. *Jackson 2030,* Mt Wallaby, 24.ix.1972. *Johns s.n.,* Wudinna, -.vi.1938. *Lay 684,* 5 km S of Yarna H.S., 29.ix.1972. *Leiblich s.n.,* Carapee Hill, 26.ix.1969, 16.xi.1969; *s.n.,* Kimba, s.d. *Mason 133, 238,* Carapee Hill, 14.ix.1974. *Orchard 1793,* 40 km from Minnipa towards Yardea, 27.x.1968. *Rohrlach 445,* Carapee Hill, 30.viii.1959; *s.n.,* Coral Rocks, Thurlga H.S., 8.x.1962. *Scoles 37,* 48 km E of Wirrulla, 10.vi.1967. *Spooner 2398,* Hiltaba, 5.ix.1972. *Symon 8087B,* 21 km SW of Yardea, 2.x.1972; *8041,* Mt Nott, 1.x.1972; *8307,* Mt Wallaby, 10.x.1972; *8373,* Norlaby Well, 6.x.1972; *9678,* Carapee Hill, 16.ix.1974. *Warnes s.n.,* Yardea H.S., 1.ix.1968. *Weber, 3083,* NE of Koondoolka, 23.ix.1972; *3371,* Mt Double, 4.x.1972.

Comments:

Ising (1958) first drew attention to this taxon as new to South Australia, but recorded it as *M. hamulosa* Turcz., [described from Western Australia], basing his identification on his collection of 1.ix.1935 and that of Johns of 21.vi.1938. Eichler (1965), while retaining *M. hamulosa,* added *M. rhaphiophylla* to the flora of South Australia, based on Rohrlach's collection of 8.x.1962.

From the original descriptions, and those given by Bentham (1867), the South Australian collections are placed in *M. rhaphiophylla.*

M. hamulosa differs in having leaves erect mostly under 1 cm long, calyx cup-shaped more or less rounded below, calyx lobes rounded, fewer stamens (6-12) on each claw, and smaller (about 3 mm diam.) fruits borne in closely compacted spikes.

18. **Melaleuca squamea** Labill., Nov.Holl.Pl.Spec.2(1806)28, t.168; Edwards, Bot.Reg.6(1820)477; DC., Prodr.3(1828)313; Benth., Fl.Austral.3(1867)155; Tate, Fl.Extratrop.S.Austral.(1890)92, in clave, 231; Black, Fl.S.Austral.ed.2(1952)609, t.811; Curtis, Stud.Fl.Tasm.ed.1(1956)201; ed.2(1975)204.

[*Type:* "in capite Van-Diemen" (Tasmania), *Labillardiere s.n.*]

Melaleuca ottonis Schau. in Otto & Dietr., Allg.Gartenz.3(1835)167.

[*Type:* In cultivation in the Berlin Botanic Gardens.]

Melaleuca squamea var. *glabra* [non Cheel, J.Roy.Soc.N.S.W.58(1924)193] sensu Black, Fl.S.Austral.ed.1(1926)409.

Shrub 1-3 m high or sometimes a small tree to 6 m high, branchlets villous at first but sometimes becoming glabrescent (stem apex with two kinds of hairs; dense short patent downy hairs, and sparse long straggling hairs), greyish, bark corky. Leaves alternate, crowded, spreading, lanceolate, acute or acuminate, incurved towards the apex, 3-nerved, shortly petiolate, 4-8 mm long, 1.5-3 mm broad. Flowers in small terminal heads or short spikes, about 15 mm diameter; bracts broad, 3-nerved and persistent during flowering, 3-5 mm or more long; rachis silky, elongating after flowering; calyx-tube about 3 mm long, campanulate, becoming glabrous, lobes short, deltoid, green, about 1 mm long and broad; petals purple, glabrous, shortly clawed, 2-3 mm long, to 2 mm broad; stamens purple or pink, claw much shorter than the petals, less than 1 mm long, with 5-7 filaments about 5 mm or more long at the end; style 4-6 mm long, slightly expanded at the apex, stigma convex. Fruits almost urnshaped, in a dense globular cluster, 5-7 mm diameter, orifice undulate, about 2.4 mm across. (Fig. 18.)

Swamp or heath honey-myrtle

Distribution (Map 10)

New South Wales, Victoria, Tasmania and South Australia.

Selection of Specimens examined

SOUTHERN LOFTY (11): *Black s.n.*, Myponga, 10.xi.1906, 10.x.1923; *s.n.*, Yankalilla, 22.ii.1928. *Cleland s.n.*, Mt Compass, 27.x.1920, 23.x.1965, 29.ii.1964; *s.n.*, Myponga, 2.xii.1923; *s.n.*, Hindmarsh Valley, -.i.1936. *Eichler 13888*, Square Waterhole, 30.vi.1957. *Gemmell 337*, Mt Compass, 6.xi.1974. *Hunt 2539*, Nangkita, 21.x.1965. *Ising s.n.*, Myponga, -.x.1932. *Spooner 349*, Tooperang, 7.ii.1968; *4515*, Mt Compass, 11.i.1976. *Whibley 16*, Mt Compass, 15.xi.1956.

KANGAROO ISLAND (12): *Cleland s.n.*, Rocky River, 18.xi.1924; *s.n.*, Flinders Chase, 28.x.1967. *Eichler 15306*, Brookland Park, 8.xi.1958. *Jackson 992*, Harriet River H.S., 4.xi.1973.

SOUTHERN-EASTERN (13): *Black s.n.*, road to Glencoe, 27.xi.1911; *s.n.*, Mt Gambier to Glencoe, 27.xi.1917; *s.n.*, Burrungule, 12.x.1928. *Bowman s.n.*, Poltalloch, s.d. *Cleland s.n.*, Mt Burr Forest, -.iii.1931. *Ising s.n.*, Burrungule, -.x.1931; *s.n.*, The Springs, 20.x.1934. *Kraehenbuehl 988*, Mt Gambier to Glencoe, 10.x.1963. *Welbourn 208*, Glencoe to Wandilo, 24.x.1964. *Wilson 583*, 4 km E of Glencoe, 13.x.1966; *888*, Marsh's Swamp, 12.x.1968.

Comments:

Black (1926) placed the South Australian specimens under *M. squamea* var. *glabra* Cheel, but later (1952) considered them to be typical of the species. Examination of the South Australian specimens shows quite wide variation in hairiness, the youngest parts being very downy and the leaves and branchlets (and often the branches) generally retaining the typical downy, silky or villous indumentum. Cheel had not seen specimens from South

Australia and it is possible that specimens from the other localities mentioned by him are distinctive. Other criteria conform so closely with type that retention of var. *glabra* at least in so far as South Australia is concerned does not seem feasible.

[A suspected hybrid with *M. squarrosa* has been collected at Marsh's Swamp (S.E. region).]

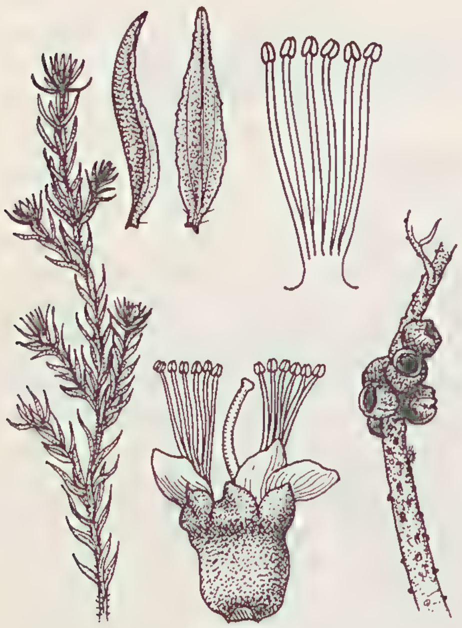


Fig. 18. *M. squamea.* A, twig, nat. size; B, leaf, upper surface, x 5; C, leaf, lateral view, x 5; D, flower, x 4; E, stamen bundle, x 5; F, fruits, nat. size.

Fig. 19. *M. squarrosa.* A, twig, nat. size; B. leaf, lower surface, x 3; C, flower, x 6; D, stamen bundle, x 5; E, fruits, slightly reduced.

19. **Melaleuca squarrosa** Donn ex Sm., Trans.Linn.Soc.6(1820)300; (Donn, Hort.Cantab.ed.2(1800)101 nomen nudum); Labill., Nov.Holl.Pl.Spec.2(1806)28, t.169; DC., Prodr.3(1828)215; Benth., Fl.Austral.3(1867)139; Tate, Fl.Extratrop.S.Austral.(1890)92, in clave, 231; Black, Fl.S.Austral.ed.1(1926)407; ed.2(1952)607, t.805; Curtis, Stud. Fl.Tasm.ed.1(1956)201; ed.2(1975)204.

[*Type:* grown by Donn in Cambridge, England, from seeds from Port Jackson, (Sydney).]

Melaleuca myrtifolia Vent., Jard. Malm. 1(1804)47.

[*Type:* cultivated in France, originating in "Iles de la Mer du Sud."]

Erect shrub or tree 3-6 or even 12 m high, glabrous or the young shoots pubescent; branchlets greyish; bark corky and papery. Leaves mostly opposite and decussate, shortly but distinctly petiolate, ovate to ovate-lanceolate, sometimes cordate, acute and often almost pungent, rigid, spreading, distinctly 5-7-nerved, usually 5-10 mm long, 5-7 mm broad. Flowers in cylindrical spikes, at first terminal or sometimes growing behind the ends of the branches, 2-4 cm long and about 2 cm diameter, rachis pubescent, bracts green, broadly ovate, 4-6 mm long and about as broad; calyx tube cup-shaped, glabrous or pubescent, 1.5-2.5 mm long, lobes short, green, obtuse, about 1 mm long; petals white, glabrous, entire, almost circular, about 2 mm diameter; stamens white or pale yellow, claw much shorter than the petals, with 7-12 filaments about 5-6 mm long; style 6-10 mm long,

scarcely expanded at the apex, stigma truncate or concave. Fruits cup-shaped, not immersed in rachis or coalescing, about 4 mm long, with orifice about 2-3 mm across, forming a rather long and dense spike. (Fig. 19.)

Bottle-brush tea-tree or scented paper-bark

Distribution (Map 11)

New South Wales, Victoria, Tasmania and South Australia.

Specimens examined

SOUTH-EASTERN (13): *Alcock 841,* Woolwash, 30,x.1965. *Anon., s.n.,* King Island, 1931 (ADW); *s.n.,* Glencoe to Tantanoola, 6.xi.1932 (ADW); *Ashby 490,* Millicent, 3.xi.1940. *Black s.n.,* Mt Gambier to Glencoe, 27.xi.1917; *s.n.,* Dismal Swamp, 5.xii.1917; *s.n.,* Millicent, -.ii.1948. *Carrick 2239,* Canunda N.P., 19.vii.1969. *Cleland s.n.,* Kalangadoo to Millicent, 6.xii.1922; *s.n.,* Macdonnell Bay, 29.v.1925; *s.n.,* Blanche S.F., 28.v.1928; *s.n.,* Mt Burr forest, 30.v.1928; *s.n.,* scrub E of Glencoe, -.iii.1931; *s.n.,* Ewens Ponds, 30.x.1941; *s.n.,* Port MacDonnell, 1.xi.1941; *s.n.,* Rendelsham, 4.iii.1944; *s.n.,* 10 km SE of Cape Banks, 28.ii.1945; *s.n.,* Lake Bonney, 17.v.1962. *Copley 3028,* 16 km W of Mt Gambier, 9.iii.1970. *Crocker s.n.,* south-east, 11.xi.1939 (ADW); *Eardley s.n.,* Eight-mile Swamp, 3.ii.1942, 5.ii.1942 (ADW). *Hunt 465,* Dismal Swamp, 21.xi.1961; *1904,* Eight-mile Creek, 14.ii.1964. *Ising s.n.,* The Springs, 19.x.1934, 22.x.1934. *Jackson 259,* 6.5 km NW of Port MacDonnell, 19.xi.1959. *Kraehenbuehl 940,* Ewens Ponds, 5.x.1963. *Lothian 2954,* Piccaninnie Blue Lake, 29.viii.1964. *Schomburgk Herb.s.n.,* Lake Edward, 1.xii.1882; *s.n.,* MacDonnell Bay, s.d. *Symon 8379,* Dismal Swamp, 10.xi.1972 (ADW). *Welbourn 93,* Furner, 11.ix.1963. *Wilson 639,* 2.6 km N of Wandilo, 5.xi.1966; *920,* Marsh's Swamp, 26.x.1968. *Wilson 1129,* Mt Burr forest, 11.xi.1959.

Comments

[Labillardiere (1806) cited *M. myrtifolia* as a synonym for *M. squarrosa,* which he had collected in Tasmania. It is possible that he may also have provided the material from which the cultivated type of *M. myrtifolia* was grown.]

20. **Melaleuca uncinata** R.Br. ex Ait.f., Hort.Kew ed.2, 4(1812)414; DC., Prodr.3(1828)213; Benth., Fl.Austral.3(1867)150; Tate, Fl.Extratrop.S.Austral.(1890)93, in clave, 231; Bailey, Queensl. Fl.2(1900)602; Black, Fl.S.Austral.ed.1(1926)409; ed.2(1952)611, t.813; Blackall & Grieve, West.Austral.Wildfl.1(1954)300, 301, in clave.

[*Type:* "South Coast of New Holland", *R. Brown s.n.* introduced to cultivation at Kew by Peter Good.]

Melaleuca drummondii Schau. in Lehm., Pl.Preiss.1(1844)138.

[*Type:* "Nova-Hollandia austro-occidentali", *J. Drummond s.n.*]

Melaleuca semiteres Schau. in Lehm., Pl.Preiss.1(1844)143.

[*Type:* "Nova-Hollandia austro-occidentali", *J. Drummond s.n.*]

Melaleuca hamata Field. & Gardn., Sert.Pl.(1844)t.74.

[*Type:* "Swan River Colony", *J. Drummond 116.*]

Erect broom-like shrub 1-3 m high, glabrous except on the young greyish branchlets; bark grey and papery. Leaves alternate, ascending, almost sessile, terete, with numerous immersed glands, acute, terminating in a fine usually curved point, with appressed silvery hairs when young, 1.5-6 cm long, about 1 mm thick. Flowers in dense globular or shortly oblong heads on short axillary peduncles which often grow out even before flowering is completed, rachis pubescent, bracts broadly ovate, almost auriculate, pubescent below, 1-3-veined, 2-3 mm long, almost as broad; calyx tube cup-shaped, silky-pubescent, about 1.5 mm long; lobes very short, obtuse, pubescent; petals orbicular-ovate, about 1.5 mm diameter; stamens white or yellowish, claw longer than the petals, about 2 mm long, each with 4-7 filaments about 2 mm long; anthers broader than long; style about 5-6 mm long, scarcely expanded at the apex, stigma convex. (Fig. 20.)

Broombush or broom honey-myrtle

Distribution (Map 12)

Western Australia, Queensland, New South Wales and South Australia. Victoria

Selection of Specimens examined

NORTH-WESTERN (1): *Francis s.n.*, Wallatinna, 2.8.1953.

LAKE EYRE BASIN (2): *Basedow s.n.*, MacDouall Peak, May, 1917. *Lay 595*, McDouall Peak, 9.x.1971.

NULLARBOR (3): *Gianakos 3179*, ca. 3 km E of Immarna, 14.ix.1970. *Lothian 3671*, ca. 8 km N of Pidinga, 20.iv.1966; *4039*, ca. 40 km S of Ooldea, 3.vi.1967.

GAIRDNER-TORRENS (4): *Cleland s.n.*, ca. 16 km N of Wilgena Station, 20.xi.1925. *Lay 456*, ca. 4.8 km W of Rickaby Dam, 18.ix.1971; *654*, Bore 20, Millers Creek Station, 14.x.1971.

FLINDERS RANGE (5): *Callen s.n.*, Mainwater Pound, 8.x.1969. *Eichler 12622*, ca. 65 km E of Leigh Creek, 15.ix.1956. *Lothian 3606*, summit of Mt McKinlay, 17.ix.1965. *Symon 3036*, near Balcanoona Station, 11.x.1964.

EYRE PENINSULA (7): *Cornwall 32*, Carappee Hill, 20.vi.1967. *Spooner 2243*, Hiltaba H.S.,3.ix.1972. *Swaby s.n.*, Hambidge Reserve. 27.iv.1966.

MURRAY (9): *Czornij 699*, ca. 15 km W of Murray Bridge, 22.vii.1974. *Ising s.n.*, Kinchina, 16.x.1930. *Specht 2290*, Hd of Billiatt, 13.x.1960.

YORKE PENINSULA (10): *Copley 2938*, ca. 6 km N of Maitland, 13.xii.1969. *Orchard 2797*, ca. SSW of Ardrossan on road to Curramulka. *Short 4*, ca. 5.5 km SSW of Port Julia.

SOUTHERN LOFTY (11): *Cleland s.n.*, Goolwa, 14.xii.1940. *Green 206*, Stirling Hills, 22.viii.1950.

KANGAROO ISLAND (12): *Andrew s.n.*, Kingscote, 8.v.1914. *Ising s.n.*, MacGillivray, 30.xii.1922. *Schodde 32*, American River, 4.ii.1956.

SOUTH EASTERN (13): *Beauglehole 19447*, SW of Bool Lagoon 16.xii.1963. *Carrick 3407*, Scorpion Spring National Park, 21.x.1973. *Green 1845*, 3 miles SE of Tintinara, 23.viii.1958. *West 2262*, Mt Shaugh Conservation Park, 2.x.1977.

Comments

[The type was collected by R. Brown on "the South Coast of New Holland". Bentham (1867) cited a Brown collection from Port Lincoln (S.A.) and this may therefore be the type locality.]

Fig. 20. *M. uncinata.* A, twig, x ½; B, leaf, nat. size; C, flower, x 6; D, stamen bundle, x 12; E, fruits, x ½.

Fig. 21. *M. wilsonii.* A, twig, x 1½; B, leaf, upper surface, x 2; C, flower, x 3½; D, stamen bundle, x 5; E, fruits, x 2/3; F, fruit, x 2.

21. **Melaleuca wilsonii** F. Muell., Fragm.2(1861)124, t.15; Benth., Fl.Austral.3(1867)134; Tate, Fl.Extratrop.S.Austral.(1890)92 in clave, 231; Black, Fl.S.Austral.3d.1(1926)406, ed.2(1952)607; Willis Handb.Pl.Vict.2(1972)452.

[*Types:* South Australia, "in deserto plagae Tatiara Country", *J.E. Woods, s.n.;* "in eremo circum lacun Hindmarsh", *J. Dallachy s.n.*]

Low straggling intricate shrub, 20-150 cm high, branchlets pale grey, branches darker, rough, fissured. Leaves decussate, crowded at apex of branchlets, erect or ascending, becoming almost patent particularly in flower, linear-lanceolate, acuminate-acute, sessile by a broad base, slightly concave above, obscurely glandular and 3-veined below, 8-15 mm long, 1-2 mm broad, Spikes axillary, rarely terminal, subtended by several membranous imbricate pubescent bracts, peduncles very short, flowers 2-5, bracteoles apparently absent; calyx tube cup-shaped, pubescent outside, about 2.5 mm long, lobes deltoid, pubescent outside and in, with a broad scarious margin about 2 mm long, 1.5 mm broad at base; petals glabrous, entire, broadly oval, 2.5 mm long, 1.5 mm broad, claw very short; stamens pale or deep pink, claw about 6 mm long, bearing 7-15 filaments 3-4 mm long at the end; style 8-10 mm or more long, slightly expanded at apex, stigma convex. Fruits corky, fissured, borne in dense or scattered clusters on rough thickened old wood, almost cylindrical, base flat, apex truncate, rim thick, crowned by woody bases of calyx lobes, 3-5 mm long, about 5 mm diameter, aperture pentagonal, about 3 mm across. (Fig. 21.)

Violet honey-myrtle

Disribution (Map 13)

Victoria and South Australia.

Specimens examined

SOUTH-EASTERN (13): *Andrew s.n.,* Coonalpyn, 15.iii.1919. *Ashby s.n.,* Wirrega, 22.xi.1944. *E.C. Black s.n.,* Coonalpyn, -.x.1950. *Cleland s.n.,* Bordertown, 24.xi.1917; *s.n.,* W. of Bordertown, 26.xi.1917; *s.n.,* Coonalpyn, -.iv.1926, -.v.1926. *Dwight s.n.,* 90-mile desert, 9.xi.1953. *Hunt 232,* Hd Senior South, 15.x.1961. *Ising s.n.,* Bordertown, 13.x.1916, 14.x.1916; *s.n.,* Tintinara, 23.x.1919; *s.n.,* Coonalpyn Downs, 27.x.1922. *Kraehenbuehl 1222,* Ki Ki, 5.xi.1964; *1227,* 12 km N of Wolseley, 6.xi.1964. *Litchfield 136,* Hd. Pendleton, -.ix.1950; *s.n.,* Hd Senior, -.xi.1950. *Menzel s.n.,* Mt Gambier, -.xi.1897. *Roach 44,* Willalooka, 21.xi.1970. *Stace s.n.,* 10 km N of Wirrega, 30.x.1955. *Symon 8378,* S of Bordertown, 10.xi.1972. *Welbourn 92,* Furner, 11.ix.1963; *212,* 10 km N of Wirrega, 25.x.1964.

Comments

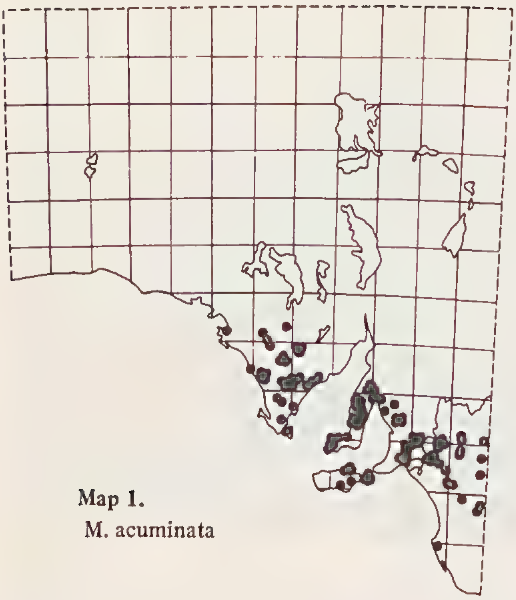
There are two specimens from the Tate herbarium, University of Adelaide, now held at AD, one annotated by Tate: "Melaleuca Wilsoni Kangaroo Is. 1895", the other similarly, in a different hand, with the addition of "October". As far as is known, the species has not been collected on Kangaroo Island since.

Excluded species

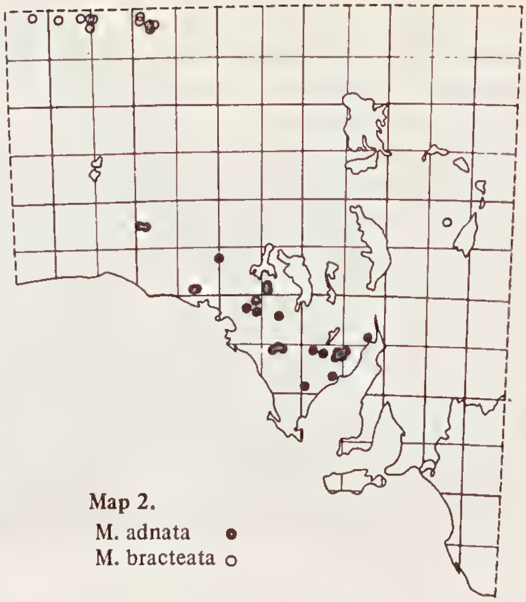
1. **Melaleuca quadrifaria** F. Muell., Wing's South Sci.Rec., n.s.2(1886); Tate, Fl.Extratrop.S.Austral.(1890)93, in clave, 231; Black, Fl. S.Austral.ed.1(1926)407, t.39, f.1-4; ed.2(1952)609, t.808; Blackall & Grieve, West.Austral.Wildfl.1(1954)295, in clave.

[*Type:* Western Australia, near Eucla, *T.D. Bate s.n.* (MEL, seen by Carrick; AD).]

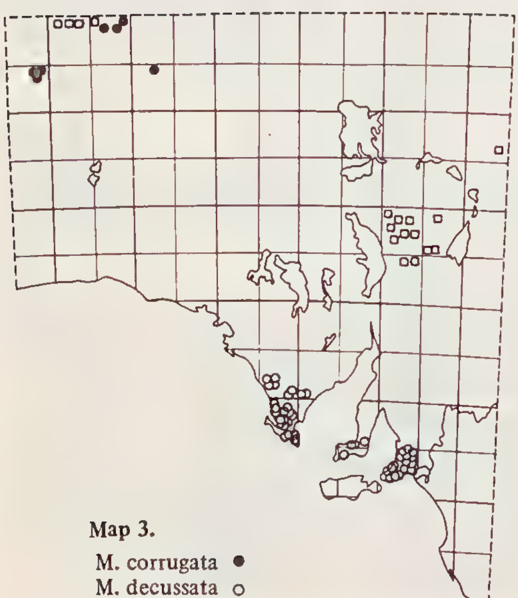
There are no specimens in AD to substantiate Black's inclusion of *M. quadrifaria* in the Flora of South Australia. AD97137174 has mounted on it a sheet from Black's herbarium with (a) two fragments annotated "A branchlet from the type Eucla 1886 (J.D. Batt). See my drawings and description in Trans.Roy.Soc.S.A.1919"; (b) drawings of leaves with notes; (c) "Copy of manuscript notes on *Melaleuca quadrifaria* by Baron v. Mueller".



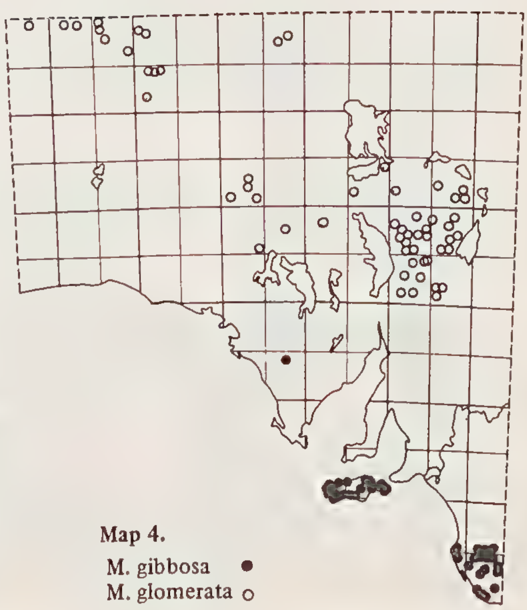
Map 1.
M. acuminata



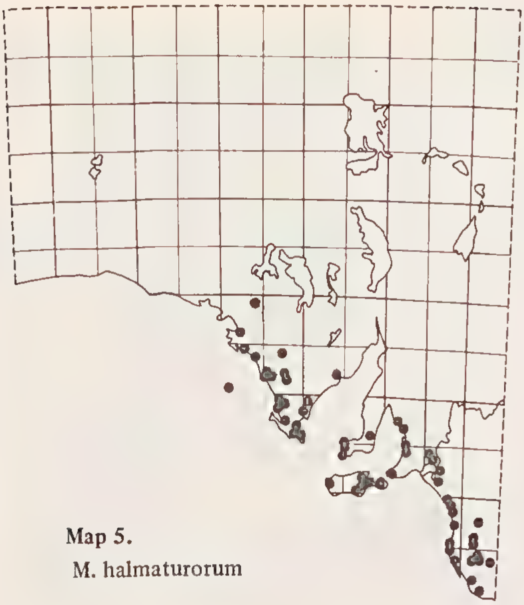
Map 2.
M. adnata ●
M. bracteata ○



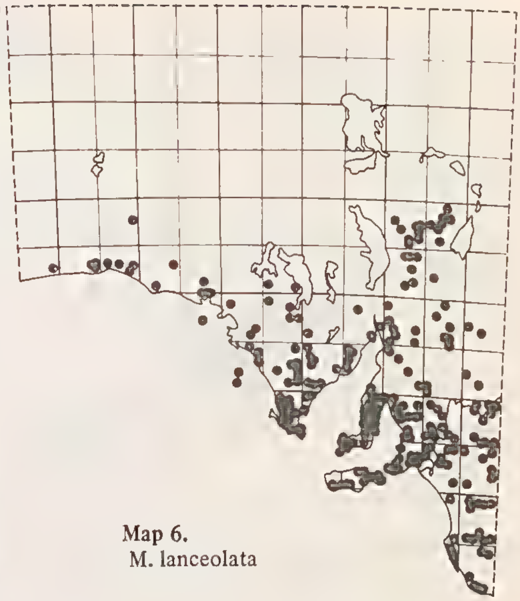
Map 3.
M. corrugata ●
M. decussata ○
M. dissitiflora □



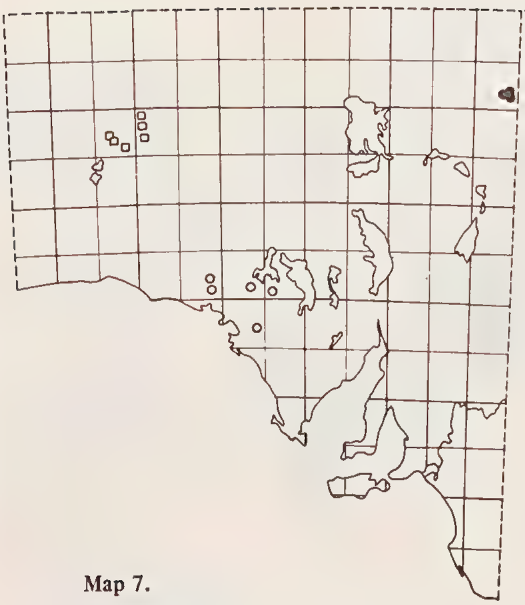
Map 4.
M. gibbosa ●
M. glomerata ○



Map 5.
M. halmaturorum

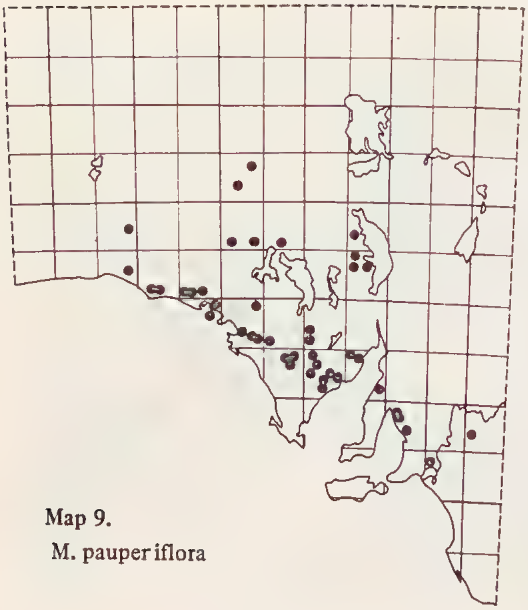


Map 6.
M. lanceolata

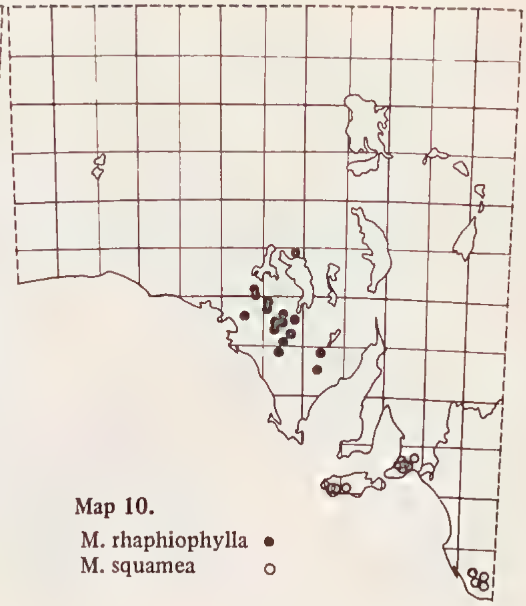


Map 7.
M. leiocarpa ○
M. linariifolia ●
M. nanophylla □

Map 8.
M. neglecta ●
M. oxyphylla ○

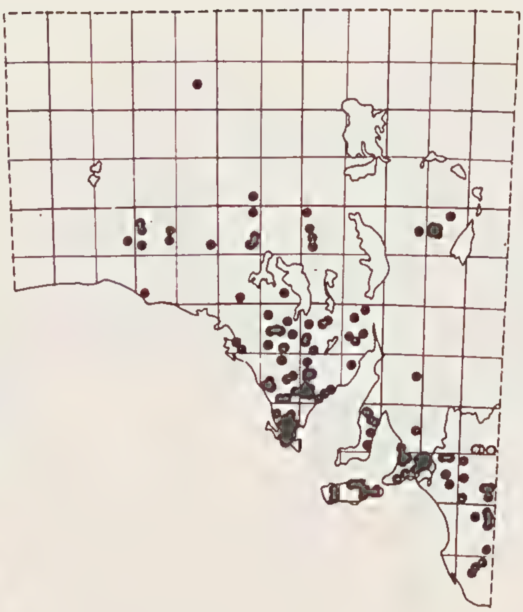


Map 9.
M. pauper iflora



Map 10.
M. rhaphiophylla ●
M. squamea ○

Map 11.
M. squarrosa



Map 12.
M. uncinata

Map 13.
M. wilsonii

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Index to Scientific Names

Names

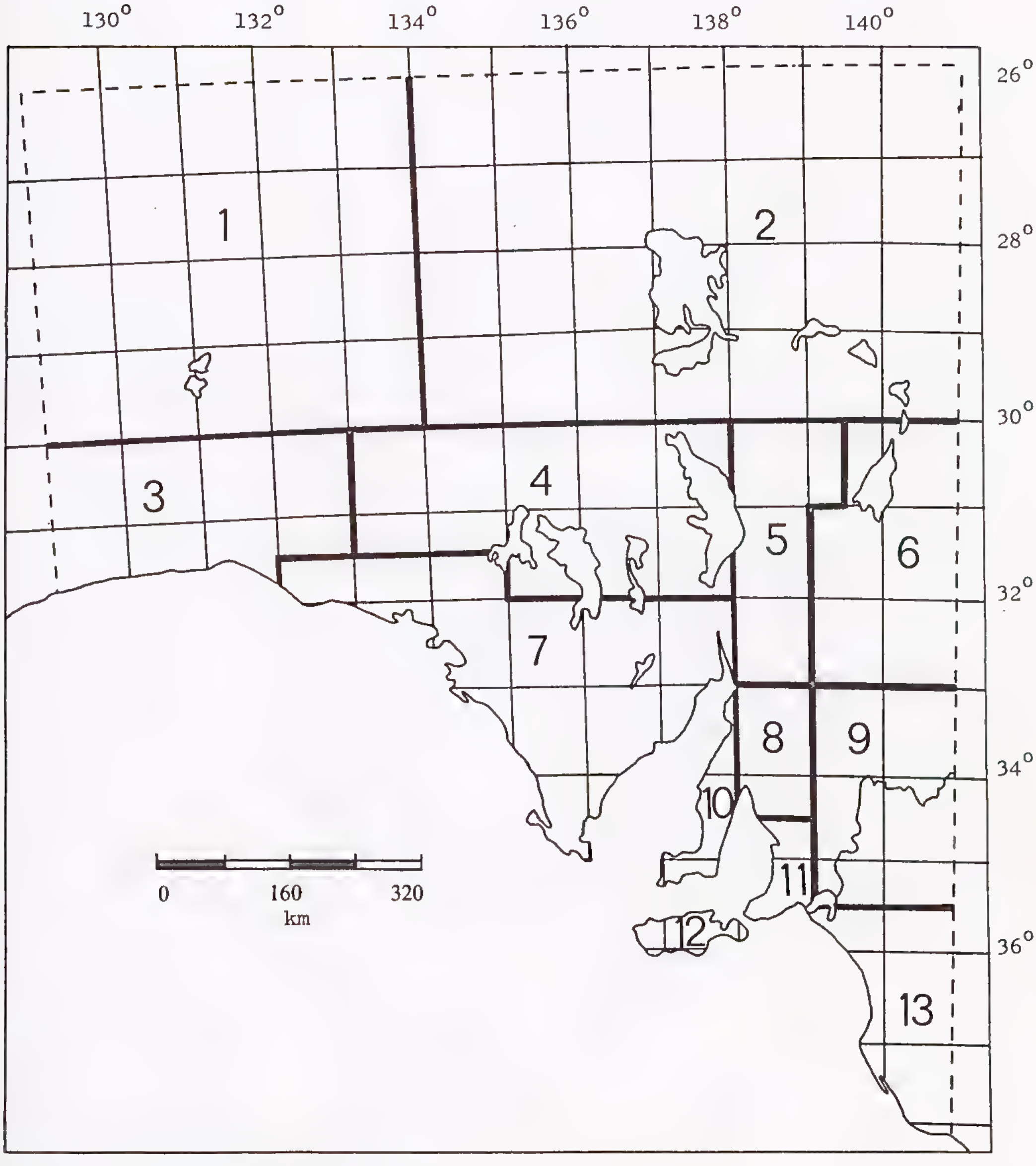
New names are in bold. Synonyms, misapplied, misspelt or illegitimate names are in italics.

Page numbers

Page numbers in bold refer to the main taxonomic treatment. Page numbers asterisked refer to figures and maps.

REGIONS OF SOUTH AUSTRALIA ADOPTED BY THE STATE HERBARIUM — ADELAIDE

1. North-western
2. Lake Eyre Basin
3. Nullarbor
4. Gairdner-Torrens Basin
5. Flinders Ranges
6. Eastern
7. Eyre Peninsula
8. Northern Lofty
9. Murray
10. Yorke Peninsula
11. Southern Lofty
12. Kangaroo Island
13. South-eastern



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JOURNAL of the ADELAIDE BOTANIC GARDENS

CONTENTS

JOURNAL of the ADELAIDE BOTANIC GARDENS

Volume 1 Part 6 6 December, 1979

Instructions to Authors

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Papers will be accepted in the following categories:

(a) Plant systematics (Australian and horticultural groups); (b) Descriptive plant morphology, anatomy and ecology; (c) Obituaries, biography and history; (d) Bibliographic studies, book reviews; (e) Botanical illustrations; (f) Noteworthy horticultural contributions.

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Smith, K. L. (1879). The species of *Danthonia* found in pastures in Victoria. *Austral. J. Bot.* 65: 28-53.

Bentham, G. (1868). "Flora Australiensis", Vol. 4. (London: L. Reeve.)

Baker, J. G. (1898). Liliaceae. In Thiselton-Dyer, W. T. (ed.), "Flora of Tropical Africa", Vol. 7 (Ashford: L. Reeve).

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When required, follow the pattern on, for example, p. 106 of vol. 1, pt. 2.

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Authors are requested to include in the synonymy only references to publications containing information additional to that to be published in the paper being submitted. Within this section journal and book titles must be consistently abbreviated. B-P-H journal abbreviations and book titles abbreviated in a similar way are desirable. Authors of references cited in the synonymy should be abbreviated.

References may be cited as:

Benth., *Fl. Austral.* 4: 111 (1868) OR
Benth., *Fl. Austral.* 4 (1868) 111.

Citation of specimens

10-30 specimens should be cited for each species (or subspecific taxon), although this may be varied under certain circumstances. The author may decide whether or not to include dates of collections and the sequence, provided a constant pattern is adhered to throughout a paper.

Authors wishing to cite all specimens seen may list them all in an index to collectors after the style of the "Flora Malesiana" identification lists. Collections not identifiable by a collection number (assigned by either the collector or herbarium) should cite dates.

Correspondence

All correspondence concerning the journal should be addressed to:

The Director, Adelaide Botanic Gardens, North Terrace, ADELAIDE, South Australia 5000.

ISSN 0313-4083

J. Adelaide Bot. Gard. 1(6): 321-331 (1979)

FRUIT DIVERSITY AND DISPERSAL IN *SOLANUM* IN AUSTRALIA

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Abstract

The forms of fruits of the Australian species of *Solanum* are described and related to their dispersal agents. The succulent berry is the most common, but trample burrs, censer mechanism, capsules, hard and dry berries and a possible tumble weed have evolved. Birds are the most commonly recorded agent of dispersal but marsupials, wild dog, bats, man, wind and water are important.

Introduction

The genus *Solanum,* with about 90 species native to Australia, has evolved a range of fruits and dispersal mechanisms. The growth habits of the native species vary from annuals to small trees, the most common being herbaceous perennials or small to medium, colonial, short-lived shrubs. The fruits of *Solanum* are typically described as berries (pulpy indehiscent fruits with seeds embedded in the flesh) but several modifications have evolved and succulent berries, finally-dry bony fruits, trample burrs, capsules, censer mechanisms and several variations less easily classified may be found.

This account has been influenced by the systematic account of dispersal by Van der Pijl (1969) who discusses many aspects of the biology involved, and the agents responsible for dispersal and the syndromes of plant characters that may be associated with each. Classification of fruits into a single category is not always possible, particularly for succulent fruits produced close to the ground which may be taken by reptiles, birds or mammals.

The types of fruits of Australian *Solanum* species and their likely means of dispersal are shown in Table I.

Dispersal by reptiles: Saurochory

The syndrome of fruit characters that Van der Pijl associates with saurochory is that fruits may be coloured, have a smell and often borne near the ground or dropped at maturity. It is obviously not an exclusive group of characters and fruits with them are also likely to be distributed by birds and mammals.

The large omnivorous skinks, e.g. Sleepy Lizard *(Trachydosaurus rugosus),* Blue Tongue *(Tiliqua scincoides)* and Spiny Skink *(Egernia stokesii)* are widespread across semi-arid southern Australia. The first is known to be partial to cultivated strawberries and tomatoes and both Sleepy and Blue Tongue Lizards have been found in the vicinity of *S.simile* which has drab green (sometimes purplish), succulent, aromatic fruit which drops to the ground when ripe. Other species with similar fruits include *S.opacum, S.vescum, S.cleistogamum, S.ellipticum, S.pungetium, S.prinophyllum.*

Species with coloured fruits that drop to the ground but which grow in mesic and/or tropical sites are beyond the geographical range of these lizards. These species include *S.discolor* which has erect and prostrate growth forms and the taller *S.macoorai, S.laciniatum* and *S.aviculare.* The fruits of the last three species are known to be eaten by birds.

Dispersal by birds : Ornithochory

The fruit characters associated with dispersal by birds are:- an attractive edible part when ripe, outer protection against premature eating and signal colours at maturity. There is less emphasis on aroma and strength of attachment, and no special placement on the plant. Neither reptiles nor birds (except Cockatoo) can usually cope with a hard rind.

Table I. The fruit types of Australian *Solanum* species.

Fruit type	Number of species	Likely means of dispersal
Succulent, red, orange, yellow berries *S. aviculare* Forst.f., *chenopodinum* F. Muell., *defensum* F. Muell., *densevestitum* F. Muell., *discolor* R.Br., *dunalianum* Gaud., *elegans* Dun., *ferocissimum* Lindl., *ferox* L., *inaequilaterum* Domin, *laciniatum* Ait., *linearifolium* Gerasimenko, *macoorai* Bailey, *nemophilum* F. Muell., *parvifolium* R.Br., *stelligerum* Sm., *tetrandrum* R.Br., *viride* R.Br., sp.nov. (yirrkalensis ms.)[1]	19	birds
Succulent, black berries *S.americanum* Mill., *semiarmatum* F.Muell.	2	birds
Succulent, drab green berries *S.capsiciforme* (Domin) Baylis, *cleistogamum* Symon, *dianthophorum* Dun., *ellipticum* R.Br., *hoplopetalum* Bitt. & Summerh., *horridum* Dun., *hystrix* R.Br., *multiglochidiatum* Domin, *opacum* A.Br. & Bouché, *prinophyllum* Dun., *pungetium* R.Br., *simile* F.Muell., *symonii* Hj. Eichler, *vescum* F.Muell., sp.nov. (terraneum ms.)	15	lizards and birds
Firm, greenish berries *S.dallachii* Benth., *dimorphospinum* C.T. White, *furfuraceum* R.Br., *hamulosum* C.T. White	4	mammals and birds
Firm, yellowish berries		
1) large, 2-4 cm diam. *S.campanulatum* R.Br., *cunninghamii* Benth., *dioicum* W.V. Fitz., *diversiflorum* F.Muell., *eburneum* Symon, *melanospermum* F. Muell., *vansittartensis* Gardner, sp.nov. (beaugleholei ms.) sp.nov. (clarkiae ms.) sp.nov, (chippendalei ms.)	10	mammals and birds
2) small, 1-2cm diam. *S.adenophorum* F.Muell., *brownii* Dun., *centrale* J.M. Black, *coactiliferum* J.M.Black, *elachophyllum* F.Muell., *eremophilum* F.Muell., *esuriale* Lindl., *lacunarium* F.Muell., *nummularium* S. Moore, *orbiculatum* Dun., *oldfieldii* F.Muell., *papaverifolium* Symon, *tetrathecum* F.Muell., *tumulicola* Symon, sp. nov. (cookii ms.) sp.nov. (hesperium ms.) sp.nov. (plicatile ms.)	17	mammals and birds
Firm, yellowish, finally hard and bony and often enclosed in a prickly calyx. *S.gilesii* Symon, *karsensis* Symon, *lachnophyllum* Symon, *lasiophyllum* Dun., *oligacanthum* F.Muell., *petrophilum* F.Muell., *quadriloculatum* F.Muell, sp.nov. (ashbyae ms.) sp.nov. (eardleyae ms.), sp.nov. (petraeum ms.)	10	? mammals
Trample burrs (berry enclosed in prickly calyx) *S.asymmetriphyllum* Specht, *echinatum* R.Br., *gabrielae* Domin, *leopoldensis* Symon, *lucani* F.Muell., sp.nov. (scitheae ms.)	6	feet of mammals
Finally dry, parchment balloon form *S.cinereum* R.Br.,	1	?wind, wash

Tumble weed	1	wind
S.pugiunculiferum C.T. White		
Finally dry, censer mechanism	1	wind
sp.nov. (tudununggae ms.)		
Finally dry, fracturing	3	?
S.oedipus Symon, *sturtianum* F.Muell., sp.nov. (heteropodium ms.)		
Unknown	2	—
S.carduiforme F.Muell., *cataphractum* A.Cunn. ex Benth.		

[1] New species combinations to be published by Symon (in preparation).

In a number of the following records it is not clear whether the birds are agents of dispersal as well as predators. The ability of birds to grind up ingested food varies greatly and a record that a bird eats a fruit does not mean that viable seeds are passed in the faeces.

All immature *Solanum* fruits are green or striped green and so are cryptically coloured. Many are also extremely bitter, containing higher amounts of alkaloids when green than when ripe, Collins (1976). The fruits of the species which are dispersed by birds change from green to orange, red or black on ripening and become succulent. A few are noticeably aromatic and none have a hard rind or prickly calyx. *S.americanum* (related to Black Nightshade,**S. nigrum* L., known to be eaten and distributed by birds), and *S.semiarmatum,* also with shiny black fruits, belong to this group.

Cleland (1918) records that the Stubble Quail *(Coturnix novaezelandiae),* Silver Eye *(Zosterops lateralis)* and the Lewin Honeyeater *(Meliphaga lewinii)* all eat fruits of the alien **S. nigrum.* Griffiths (1977) reports that the Mistletoe-bird *(Dicaeum hirundinaceum)* will also feed on the berries of this species. Barker in Frith (1976) reports that the Stubble Quail in south-eastern Australia frequently contains minor amounts of unidentified *Solanum* seeds.

The ravages of birds have been seen on *S.laciniatum* which has succulent orange-yellow fruits. Paton (1976) reports that Silver Eyes *(Zosterops lateralis)* and Yellow Faced Honeyeaters *(Lichenostomus chrysops)* reduce the fruits to empty skins while still on the bush. The author has noted that birds eat *S. aviculare,* **S. erianthum* Don, and **S. mauritianum* Scop. and *S. linearifolium* (Fig. 1, no.5) probably belongs here also.

Tropical pigeons are known to eat the fruits of several species of *Solanum.* Lea & Gray (1935) recorded that Wonga Pigeons *(Leucosarcia melanoleuca)* ate unidentified *Solanum* berries at Imbil, Queensland. Frith & Barker (1975) recorded unidentified *Solanum* seeds in two Plumed Pigeons *(Geophaps p. plumifera* and *G.p.ferruginea)* in arid north western Australia. In all cases the number of seeds collected was quite low. Frith (1976) records the Banded Pigeon *(Ptilinopus cinctus)* eating fruits of the alien **S. mauritianum* and it is probable that fruits of the closely related **S. erianthum* would also be eaten. Crome (1975) working in tropical, lowland rainforest 50 km south of Innisfail, Queensland found that the frugivorous Brown Pigeon *(Macropygia amboinensis)* ate *Solanum* fruits and that berries of the weedy, alien species **S. torvum* Swartz were a consistently important food source. Its fruits, which are greenish or greenish-yellow, were available over a longer period of time than any of the other 55 food plant species recorded. The Brown Pigeon was the only one of the seven pigeons investigated that was found to contain *Solanum* fruits. Fruit was always taken from the crown of the trees and fallen fruit was never seen to be taken. *S. viride* with succulent, red fruit was also a minor component of diet.

* Introduced species.

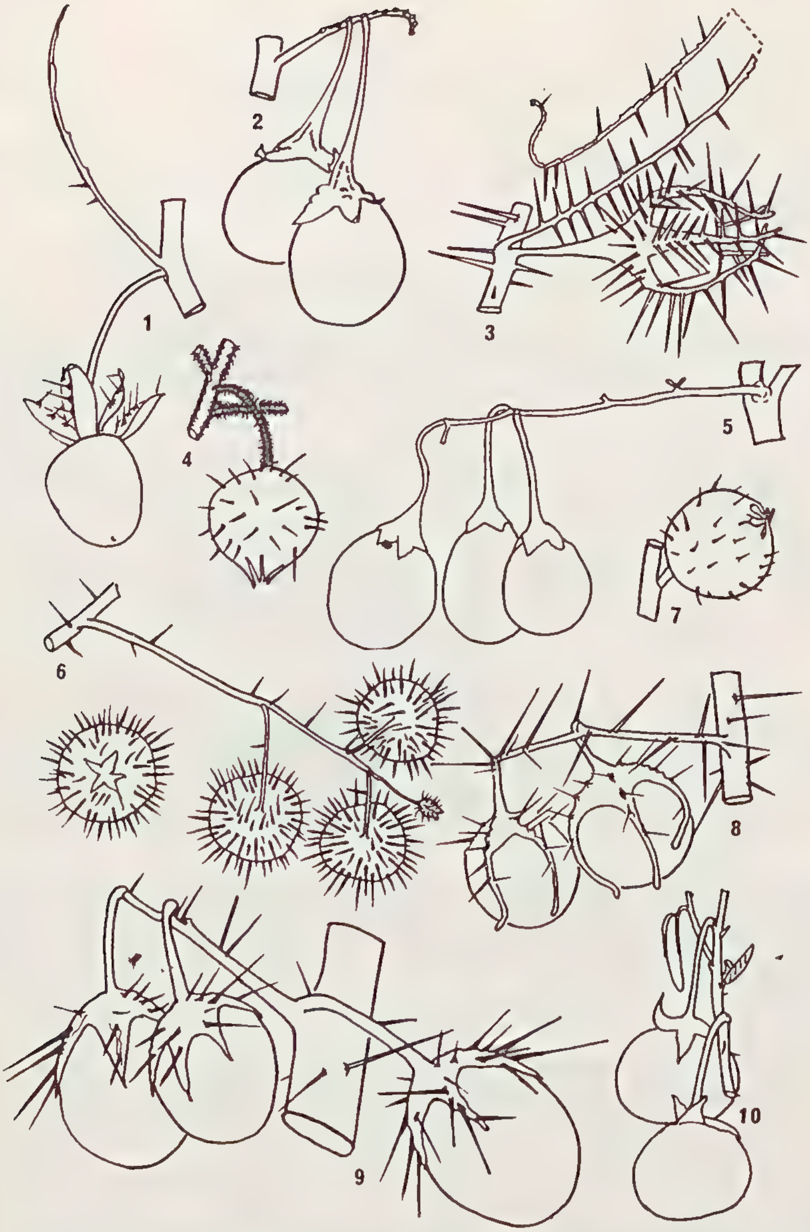

Fig. 1. Drawings of selected Australian *Solanum* fruits, about natural size, the lower four x 1.5.

1. *Solanum melanospermum:* Large yellow berry, prickly calyx reflexed when ripe.
2. *S. dallachii:* Firm green fruit, shed when mature.
3. *S. oedipus* Green, scarcely fleshy, finally sub-capsular.
4. *S. gilesii:* Greenish fruit, finally firm, enclosed in calyx.
5. *S. linearifolium:* Succulent ochre-yellow fruit.
6. *S. echinatum:* Trample burr; firm, greenish berry enclosed in calyx.
7. *S.* sp.nov. Subcapsular berry remaining enclosed in calyx.
8. *S. petrophilum:* Firm yellowish fruit, finally pale and bony.
9. *S. cinereum:* Firm yellowish fruit, finally parchment like balloon.
10. *S. coactiliferum:* Firm yellowish fruit.

Two Aboriginal inhabitants from Yirrkala, Rita Baakili Gurruwuwuy and Margaret Djwanydangu Yunupingu have reported through Scarlett (1976) that two pigeons, Laparr, Green Winged Pigeon *(Chalcophaps chrysochlora)* and Jukuk, Peaceful Dove *(Goepelia placida)* feed on the red fruits of a new species of *Solanum* from Yirrkala, Arnhem Land.

Crome (1976a) in an account of the breeding and feeding of the Torres Strait Pigeon *(Myristicivora spilorrhoea)* at the Low Isles (N.E. Queensland) reports that **S. torvum* and **S. mauritianum* were both eaten and excreted by the birds. Both these are alien species and the observations add significance to the importance of frugivorous pigeons as dispersal agents of *Solanum* in these tropics. Some species with succulent red fruits which are probably eaten by birds include *S. stelligerum, S. densevestitum, S. tetrandrum* and *S. parvifolium.*

There are few records of parrots eating *Solanum* fruits. Lea & Gray (1935) report that the Rainbow Lorikeet *(Trichoglossus moluccanus)* from Encounter Bay, South Australia, contained unidentified *Solanum* seeds and the Mallee Ringneck *(Barnardius barnardi)* from Mannum, South Australia contained "many larger yellow seeds of a *Solanum* species". The Adelaide Rosella *(Platycercus elegans)* from Mt Remarkable, South Australia, contained seeds of an unidentified *Solanum* and a bird from Second Valley, South Austrlaia, contained seeds of **S. nigrum.*

In Australia the Emu *(Dromaius novaehollandiae)* probably deserves special consideration as an agent of dispersal. It is a large, omnivorous, flightless bird once found widely throughout Australia. It is known to eat almost any flower or fruit it can swallow, including the spiny aggregate fruits of *Dissocarpus paradoxa* (R.Br.) F.Muell. Innumerable seeds and bony endocarps of *Acacia, Eremophila, Nitraria, Myoporum, Santalum, Leucopogon* etc. may be found in its faeces. It is probable that Emus eat a wide range of *Solanum* fruits. I have seen them eating the succulent green and aromatic berries of *S.ellipticum* which are produced at ground level below the leaves. The birds probed around the base of the plants and after seizing a fruit raised their heads to swallow it. Faeces collected at the time contained entire fruits with intact prickly calyx and pedicel as well as seeds. Examination of three faeces samples showed the presence of 2,000, 2,800 and 7,000 seeds or remnants, some of which appeared to be sound.

Noble (1975) records that in some months *S.esuriale* may constitute up to 25% (dry weight) of the diet of Emus on the riverine plain of New South Wales. No comment is made on the condition of the seeds passed in faeces but some could be expected to be viable. Latz (1976) records that Emus in an area near Tanami, Northern Territory, ate "copious quantities" of *S.centrale* and *S.gilesii.* It is not surprising that *S.centrale* is eaten as the berry is exposed and known to be palatable. The berry of *S.gilesii* is covered by a prickly calyx which is obviously an inadequate deterrant in this case. Almost any *Solanum* fruit produced between ground level and 2m would be accessible to Emus as well as any fruits that are shed. It is now obvious that there is not likely to be much distinction between the fruits eaten by reptiles and Emus and indeed many of the other categories.

Australia's second large, flightless bird is the Cassowary *(Casuarius casuarius)* which, unlike the widespread Emu, is narrowly confined to tropical scrubs and rainforests of northern Queensland. Crome (1976b) reports them to be omnivorous fruit eaters. In particular they eat fallen fruit and occasionally fruit from branches. Usually the pericarp of the fruit is digested and the seeds are excreted whole. He reports finding **S.torvum* in their faeces and Hyland (1976) reports that the large reddish fruits of *S.macoorai* occur in their droppings near Atherton. In view of Crome's observations on their habit of eating fallen fruit it is likely that they may be one agent distributing the seeds of other *Solanum* species. In the area there are four tall or scrambling species that produce yellow/orange/green fruits of moderate size (1-2 cm diam.) which may fall when ripe, including *S.dallachii* (Fig. 1, no.2) and *S.hamulosum.* As Jansen (1975) points out, the mere release of fruits from the parent

plant may not constitute dispersal. Seeds on the ground beneath the parent tree are very likely to be undispersed seed. Seedlings developing close to the parent may result in intense conspecific competition particularly among perennials. It is probable that fruits released on to the ground are placed within the reach of some dispersal agent, in this case the Cassowary. It is noteworthy that at least a dozen varied *Solanum* species shed their fruits, usually with their pedicels, when ripe in Australia.

Dispersal by mammals : Mammaliochory

Adaptive mammaliochory of fruits is perhaps not so readily detected. Van der Pijl considers that a firm skin is less of an impediment to consumption, and some protection of the seed proper against mechanical destruction could be expected. Aroma may attract the animals and fruits are often of larger size and have to be accessible. As many Australian marsupials are night feeders (or at least dawn and dusk), or are arboreal, fruit colour may be less important.

It will be seen from Table 1 that the largest single category of fruits in Australian *Solanum* is that with firmish yellow fruits, all of which are produced on small shrubs up to 2m high. These species fall into two sub-groups, one with medium sized (1-2cm diam.) exposed fruits with pale seeds, e.g. *S. esuriale,* and a second group with larger fruits (2-4cm diam.) partially enclosed in prickly calyces. The latter have black seeds. In northern Australia the species in the second sub-group have larger fruits protected by prickly calyces which relax or reflex to expose the fruits when ripe. These fruits may be held along or below the branches and do not normally seem to drop off. Examples are *S.phlomoides, S.eburneum, S.melanospermum* (Fig.1, no.1), *S. dioicum* and *S. cunninghamii.*

Van der Pijl pleads for information on the relations between diaspores and kangaroos in Australia. Normally the larger kangaroos and wallabies eat grass, herbs and foliage and are not fruit-eaters. I have seen evidence on Eyre Peninsula of kangaroos eating the fruits of *S. coactiliferum,* (Fig.1, no.10). This is a small shrub with unarmed, firm, yellowish fruits. It is widespread in southern Australia with a suite of about 15 related species including *S. esuriale, S. tetrathecum, S. oldfieldii, S. orbiculatum.* However many of these would be accessible to both reptiles and birds. Cleland and Tindale (1954) briefly describe *S. quadriloculatum,* a species with a firm yellow fruit finally becoming hard and bony, as "kangaroo food, not used by the natives" and *S. ellipticum,* with succulent green fruit at ground level, as "eaten by euros and wallabies". Newsome (1976) has recorded the Red Kangaroo *(Megaleia rufa)* eating *S. ellipticum* in Central Australia. Waring (1976) reports that the Quokka *(Setonix brachyurus),* a small wallaby, eats *S. simile* in W. Australia.

Despite the widespread occurrence of possums in Australia and their frugivorous/herbivorous diet the only records of their consumption of *Solanum* is a report by Martin (1969) that they eat the fruit of *S. vescum* in Tasmania.

The Wild Dog, Dingo *(Canis familiaris dingo),* like the Emu, was once widespread in Australia both wild and semi-domesticated by the Aborigines. Dingoes are basically carnivorous but include large insects and fruits in their diet. Finlayson (1943, p. 142) says of the dingo, "in virgin country a mixed feeder, depending partly on fruits (especially those of the numerous *Solanum)".* Unfortunately no species names are given. Newsome (1976) has found the seeds of *S. vescum* to be common in their faeces at Nadgee (S-E of N.S.W.) and it is probable that allied species such as *S. simile, S. laciniatum, S. aviculare, S. linearifolium* (Fig.1, no.5) were also eaten. It is possible that dingoes may occasionally eat fruits of a wide range of species that are within reach or shed on the ground. In addition Newsome also found seeds of *S. vescum* in faeces of the introduced European Fox *(Vulpes vulpes).*

The Flying Foxes *(Pteropus* spp.) are widespread in tropical Australia and feed on blossoms and various fruits, usually well above the ground in trees. Ratcliffe (1931) found that they fed on "Wild tobacco *Solanum* sp., a tall herb, profuse in cleared rain forest area".

This is most probably **S. mauritianum* which is now abundant as a weedy, small tree, but could also include **S. erianthum.* Both of these species are introductions to Australia, **S. erianthum* before white settlement and **S. mauritianum* later. Both come from Central America and their dispersal agents there would be of interest. Because of their delicate wing membrane it is perhaps unlikely that bats scrabble about the more prickly solanums which in any case do not present their fruits conveniently to them.

Transport on the surface of animals : Epizoochory

Fruits dispersed on the surface of animals may have adhesive mechanisms such as spines, hooks or viscid exudates. This category has been exploited in *Solanum* by the production of trample burrs in some six species. The berries of *S. echinatum* (Fig.1, no.6) and *S. lucani* are relatively small and surrounded by densely prickly calyces. The berries are produced at ground level and are shed *(S. echinatum)* or readily broken off *(S. lucani)* when ripe. *S. gabrielae* sheds larger globular, viscid and prickly fruits from a small shrub, and *S. leopoldensis* sheds bony berries partially enclosed in a raised prickly calyx. It is no coincidence that all of these species occur on rocky outcrops and defiles favoured by wallabies.

The somewhat larger, less prickly fruits of *S. asymmetriphyllum* may also belong here, but there seem scarcely enough prickles to attach this fruit to a passing foot. It too grows on rocky sites. Van der Pijl points out that burry fruits may also serve as anchoring mechanisms to facilitate germination and establishment, but as each of these berries may contain several hundred seeds, seedling competition could be intense and they are in marked contrast to the few seeds present in the classical trample burrs such as *Emex* or *Tribulus.*

Man as a dispersal agent : Anthropochory

The Australian Aborigines are food gatherers and do not practice agriculture. A number of *Solanum* species are gathered and eaten by them. I do not know if viable seeds are found in their faeces. However, the gathering, transport and consumption of fruit would certainly have resulted in dispersal of seeds. The fruits of *S. chippendalei* (large, firm, yellow) are popular and seeds scraped out before the fleshy part is eaten (Gould, 1969). In addition *S. ellipticum, S. cleistogamum* and particularly *S. centrale* are popular with the central Australian Aborigines and are consumed in large amounts. Records of *Solanum* eaten in southern Australia are meagre but *S. esuriale* (Mitchell, 1839), *S. vescum* (Mueller, 1855), *S. laciniatum* (Roth, 1899), and *S. simile* (Richards, 1882) are known to have been eaten. All of these species have succulent yellowish or greenish fruit. I have found no record of the consumption of *Solanum* in the high rainfall tropics and Specht (1958) does not include any species in his account of the ethnobotany of Arnhem Land. Latz (1976) reports that Aborigines near Tanami, Northern Territory eat *S. gilesii* which at first glance does not appear to be an attractive species. Wherever the fruits were handled or eaten the seeds were likely to be discarded in the vicinity of camps and to be in the disturbed sites frequently occupied by *Solanum.* For a summary of the Aboriginal consumption of Solanaceae see Peterson (1976).

Modern man has been an active agent in transporting native species to new sites. *S. aviculare* and *S. laciniatum* have become established in Eyre Peninsula, South Australia and also in Western Australia, most likely as garden escapes. *S. cinereum* from N.S.W. is now established in South Australia. *S. capsiciforme, S. oligacanthum* and *S. sturtianum* have all been found far from their original areas of establishment, the last two along railway lines suggesting transport by stock.

Wind dispersal : Anemochory

Many wind dispersed fruits and seeds are known; Van der Pijl lists flyers, rollers and throwers.

Fig. 2. *Solanum* sp.nov. (S. tudununggae ms ined) showing the fruits held high on a willowy stem, Kalumburu, W. Aust.

The unique, as yet unnamed *Solanum* from Kalumburu (Kimberleys, W.Aust.) may be a wind ballist. This species is tall and slender (to 2m) and is sparsely branched. The fruits are firmly held to the stem by tough pedicels. The berry is enclosed, except for a small orifice, by a firm globular calyx. The berry within, which is broadly attached, is circumcissile at its base and when shed shrinks to form a loose cap within the calyx. The seeds are then released through the orifice of the calyx when the stem is knocked, shaken or blown (a censer mechanism). I know of no other species like this in the genus (Fig.1, no.7; Fig.2).

The species *S. sturtianum* may be a less specialised wind ballist. The berries at first firm and yellowish, are held erect on short pedicels on a shrub 0.5-2 m tall. The berries are finally almost black with a brittle, dry skin. The relatively large dark seeds drop out or can be knocked out when the fragile skin breaks, and could belong to one of Van der Pijl's last group — barochory — seeds dispersed by weight. A somewhat similar small group of 4 species from the Kimberleys includes *S. oedipus* (Fig.1, no.3) and *S. heteropodium.* Their berries are initially green, not fleshy and enclosed in very prickly calyx lobes. The lobes eventually spread widely and the scarcely succulent fruit containing relatively large dark seeds disappears. The agents are not known, but like the new species mentioned above, the berry is very broadly attached to the calyx and it is difficult to remove the ripe berry as an intact unit.

S. pugiunculiferum is possibly a tumble weed although the plants have not been seen in motion. This is an annual species (very rare in Australian *Solanum)* and it grows in northern Australia on flats of heavy, cracking clays following seasonal flooding. The plants are very prickly, somewhat rounded in form, the berries small, firm, green and the seeds flat and papery.

A possible wind ballist of the balloon type is the berry of *S. cinereum* (Fig.1, no.9). These large yellowish berries finally dry to form a brittle parchment-like sphere with the seeds adherent to the placenta; at this stage they have the smell of dried fruit, (dried litchi). The spheres are not readily freed from the pedicels and their method of dispersal is obscure.

Other methods of dispersal

A group of about eight species has firm yellowish berries that finally become hard, pale and bony at maturity. They are often enclosed in a prickly calyx. There is no dehiscence and the fruits remain on the bushes for long periods. Examples are *S. petrophilum* (Fig.1, no.8) and *S. quadriloculatum,* both of which have long prickly calyx lobes enclosing the berries and *S. gilesii* (Fig.1, no.4), *S. lachnophyllum* and *S. lasiophyllum* which have their berries enclosed in a prickly calyx tube. The means of dispersal are obscure though *S. quadriloculatum* at least may be eaten by Kangaroos (Cleland & Tindale, 1954). However it is also possible that after the short-lived plants have collapsed the intact fruits may be blown, washed or trampled to new sites.

No dispersal by ants, fish or rodents have been recorded, nor are examples of plumose, winged flyers or active ballists known in Australian *Solanum.*

It is of interest to compare dispersal of fruits of *Solanum* in Australia with that on a cross section of *Solanum* species described by D'Arcy (1973) and Gentry & Standley (1974) in Panama and Guatemala. A total of 93 species are dealt with by D'Arcy and Gentry and Standley, of which 85 have adequate descriptions of the fruit for comparison to be made. Most of the fruits are globose or ovoid, but two species have fruits described as flat or lance shaped, a form not present in Australia. Conspicuously pubescent fruits occur in 10 species. This characteristic is almost absent in Australia; only *S. ferox* is conspicuously pubescent and this species is localised and probably a recent introduction. Two sparsely pubescent species here, **S. erianthum* and **S. mauritianum,* are both of American origin. The most common fruit colours present were red/orange/yellow (34 species), purple/black (19 species), green (12 species), white (4 species — not present in Australian species) and 24 species had no colour specified. A conspicuous difference between the two areas is the number of species in Australia with fruits enclosed in often very prickly calyces. In Australia there are at least 15 such species in contrast to two in Panama-Guatemala. The distribution in Australia of species with berries enclosed in calyces is predominantly in the arid and monsoonal areas with relatively open vegetation forms. None are found in the high rainfall or rainforest areas of eastern Australia. No *Solanum* fruits from Panama-Guatemala appear to be capsular (with the exception of the introduced *S. cornutum),* and none have finally hard bony berries. In Australia the former are mainly in the monsoonal tropics and the latter essentially in the arid areas.

Concluding remarks

Although factual records of dispersal are not abundant it can be seen that a wide range of agents are involved and that the 'berry' of *Solanum* has been subject to considerable diversification and adaptation.

The species of *Solanum* in Australia are grouped by Symon (in preparation) in a number of subgenera which have not been elaborated here. In the subgenus *Archaesolanum,* Kangaroo Apples, all seven species have typical succulent berries as do the few examples of subgenus *Solanum,* Black Nightshade. Greatest diversity of fruit form occurs in the prickly stellate-haired subgenera and within these the andromonoecious and androdioecious species (concentrated mainly in northern and especially north western Australia) show most variation. It is of interest that in the relatively large group of tuber-bearing species (about 200) in the Americas, nothing like the Australian range of fruit form occurs. Nor in the smaller Black Nightshade subgenus *Solanum* (perhaps 50 species) does there appear to be much variety of fruit form. The subgenus *Brevantherum,* of about 27 species mainly in Central America, also has relatively uniform succulent berries. In many of the older and even recent accounts, the descriptions of *Solanum* fruits are inadequate, no doubt due to the fact that a pressed succulent berry makes a mouldy mess whose structure is difficult to measure and describe.

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THE NATIVE AND NATURALISED *CYPERUS* SPECIES IN SOUTH AUSTRALIA

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Abstract

The 25 species of *Cyperus* recorded in South Australia are considered in terms of their distribution ranges. It is concluded that *C. bulbosus, C. difformis, C. exaltatus, C. iria, C. pygmaeus, C. rotundus* ssp. *retzii* and *C. squarrosus* range through the tropics, extending southwards to the eremaean zone of South Australia; and *C. clarus, C. cunninghamii, C. dactylotes, C. gilesii, C. gunnii, C. gymnocaulos, C. rigidellus, C. rutilans, C. vaginatus* and *C. victoriensis* are endemic to Australia. Of the remainder, *C. arenarius, C. congestus, C. eragrostis, C. flabelliformis, C. laevigatus* and *C. tenellus* are considered to be introduced to Australia, whereas *C. brevifolius, C. rotundus* and *C. sanguinolentus* are probably native to eastern Australia but introduced to South Australia.

It is suggested that there are no natural disjunctions of species between temperate Australia and other temperate areas. Those that have been recorded are due to misidentification or other errors.

Introduction

A significant piece of information found in each entry in most floras is the plant's status as an exotic or native. A standardised notation has been developed where the presence of an asterisk preceding the botanical name indicates an exotic species. Perhaps the physical insignificance of this symbol has led to a general underestimation of the importance of the information that it is meant to convey.

Yet the question of whether a given species is native or introduced is of great significance. Evolutionary theorists, plant geographers and taxonomists use this information to arrive at some of their major decisions. In contrast to the other species' data found in floras which is generally a distillation of various measurements and observations, the plant's status is an opinion. In the early days, misidentifications, incomplete knowledge of patterns of European settlement and related plant introduction, uncertain localities of early records and underestimations of how far and how fast plants may spread, led to errors in assessing the status of Australian plants.

With the benefit of hindsight and a better knowledge and understanding of the facts enumerated above, a number of corrections can be made to early publications. For example, Bentham (1863-78) included 145 species which are now known to be alien to South Australia. However, of these he recorded that 91 were native to Australia (Kloot, unpublished data). In later years the more obvious mistakes were rectified, yet the weight of tradition is not easily dislodged and some of Bentham's errors still persist. For example, *Alyssum linifolium* Steph. ex Willd., considered to be native to Australia by Bentham (1863), was still recorded as such by Black (1948) and Willis (1972) although the error has since been appreciated and will be amended in a future publication (H.J. Hewson; *in litt.).* *Emex australis* Steinh. was recorded as native by Bentham (1870) and is still recorded as an Australian native by Airy Shaw (1973) and Good (1974). Both these latter works are considered authoritative in their fields and this error (among others) will continue to be disseminated.

In this paper, the status of the South Australian species of the genus *Cyperus* have been examined but it is believed that the approach may be more widely applicable. This is not a taxonomic revision and the nomenclature used is that of Jessop (1978). It is hoped that the findings presented here will harmonize with such a revision presently being prepared by Mrs Karen Wilson (NSW).

Procedure

The locality records of herbarium specimens and distribution data provided in the published floras of South Australia, Australia generally and other countries were examined. The nature of the habitats where the respective species were found was also considered. Herbarium specimens were examined to ensure that names were used consistently (although whether they were used correctly must wait for Mrs Wilson's taxonomic revision).

Attention is also paid to the date of first records and their respective locations in the light of European exploration and settlement in that area at that time. No assumptions were made beyond those made in flora writing, i.e. that data derived from collections provide a factual basis for assessing distribution, and that later revisions and distribution data therein are more accurate than conclusions reached last century in the early days of general exploration and botanical investigation in the Australasian region. In the interpretation of such data and in forming conclusions, assumptions about plant distribution must be made which will be discussed further on.

Discussion

The genus *Cyperus* is pantropical extending into warm temperate regions (Airy Shaw, 1973). In South Australia, 25 species are recorded of which four are considered introduced (Jessop, 1978). If all of the species are grouped according to their ranges within South Australia, and according to their contiguity with other populations in Australia and beyond, five types of distribution are immediately apparent.

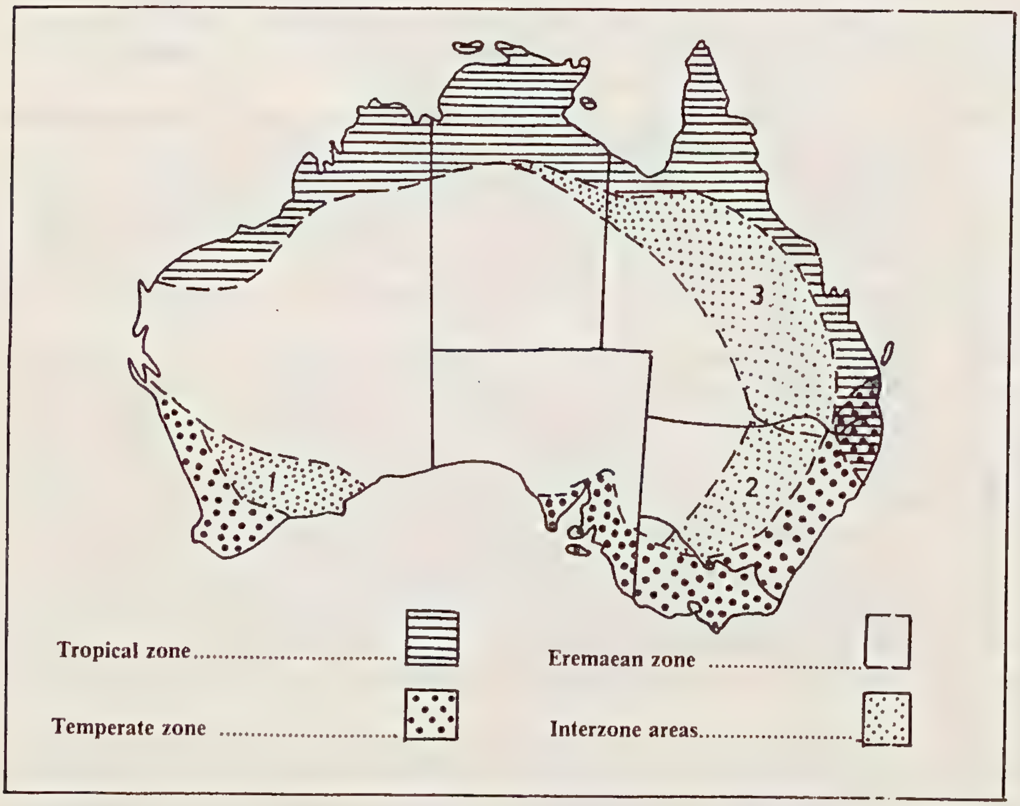

Fig. 1. The principal floristic zones of Australia (after Burbidge, 1960).

1. Tropical, extending to South Australia

Within Australia, these species occupy Burbidge's (1960) tropical and eremaean zones and her interzones 2 and 3 (Fig. 1). The South Australian populations are on the southern edge of their range. In all cases the local populations are continuous with those in adjoining States and in adjoining countries from where they are also recorded as native e.g. Java (Backer and Bakhuizen van den Brink, 1968) and Malesia (Kern, 1974).

Within South Australia these species are found in the north of the State, not occurring farther south than the Flinders Ranges and Eastern (occasionally Murray) regions delineated by Jessop (1978). These species are:-

C. bulbosus Vahl
C. difformis L.
C. exaltatus Retz.
C. iria L.
C. pygmaeus Rottb.
C. rotundus L. ssp. retzii Kuek.*
C. squarrosus L.

2. Endemic to Central and Northern Australia

This group has the same distribution within South Australia and occupies the same botanical zones (Burbidge, 1960) in Australia as the previous one. However these species are not found beyond Australia. In some cases, the ranges are quite small but these are within the general area as defined.
The species are:-

C. clarus S.T. Blake
C. cunninghamii (C.B. Clarke) C.A. Gardner
C. dactylotes Benth.
C. gilesii Benth.
C. rigidellus (Benth.) J.M. Black
C. victoriensis C.B. Clarke

3. Endemic to Southern Australia

Within Australia, the species of this group are found in the temperate and eremaean zones and interzone 2 (Fig. 1). The South Australian records of this group occur throughout the State. Local populations are continuous with populations in adjoining States.
The species are:-

C. gunnii Hook. f.
C. gymnocaulos Steud.
C. rutilans (C.B. Clarke) Maiden & Betche
C. vaginatus R.Br.

4. Disjunct Australian populations

In this group, the range of each species within South Australia and Australia generally is restricted. Separated populations or stands in different localities are common. But the major distinguishing factor of this group is that the Australian populations are disjunct with populations outside the continent. This is to be contrasted with the first group which is continuous through the islands to the north and north-west of Australia to Asia and beyond.

The species, their origins and status according to Jessop (1978) are as follows:-

* Nomenclature after Jessop (1978). This is considered to be a distinct species, *C. bifax* C.B. Clarke (cf. Blake, 1942).

Species	Origin	Status according to Jessop (1978)
C. arenarius Retz.	Asia	Introduced
C. congestus Vahl	South Africa	Introduced
C. eragrostis Lam.	South America	Introduced
C. flabelliformis Rottb.*	Africa, Arabia	Introduced
C. laevigatus L.	Mediterranean	Native
C. tenellus L.f.	South Africa	Native

5. Disjunct South Australian populations

In this small group, the South Australian populations are disjunct with those found elsewhere in Australia, in particular, those of the north-east coast and adjacent areas, populations which are continuous with those of adjacent countries and almost certainly natural extensions of their tropical range. The South Australian records are restricted almost entirely to the Adelaide area and adjacent southern hills. Jessop (1978) regards them all as natives.

The species are:-

C. brevifolius (Rottb.) Hassk.
C. rotundus L. ssp. *rotundus*
C. sanguinolentus Vahl

The introduced species

In the last two groups the disjunction of the South Australian populations, in particular, is taken to indicate that those species are not native to this State but are introduced to their present locations. To allow further discussion about these cases and the principles that may be drawn from them, each of the species with disjunct South Australian distribution will be discussed.

1. *C. arenarius*

This species has not been recorded anywhere in Australia apart from its single occurrence at Port Augusta where it was first recorded in 1961 (Symon, 1964).

2. *C. congestus*

This is a garden escape first noted as a weed at Burnside in 1940 (Blake, 1943). It is now found in the Adelaide Hills and lower south-east.

3. *C. eragrostis*

Another garden escape that has been collected once in the south-east, which was the first local collection (in 1961), and a few times in the Adelaide area.

4. *C. flabelliformis*

A further garden escape which has become established in a small persistent patch in Waterfall Gully where it was first collected in 1942 (Blake, 1943).

5. *C. laevigatus*

The first collection in South Australia was made by Helms at Nilpena in 1891 (Black, 1919). It was recorded as *C. distachyos* All. from both the Mt Lyndhurst run and from Middleton Creek, near Goolwa in 1898, and a further collection made at Coward Springs, west of Marree in 1919 (Black, 1919). Specimens lodged under that name in AD have been collected widely throughout the State since, particularly from the interior. However upon examination, the southern collections are quite different in appearance to the northern material, upon which the locally published descriptions of the species are based. Blake (1943) compared central Australian material with genuine Mediterranean specimens and found that they were identical. It is suggested that this southern material is another species,which is discussed below as *Cyperus* sp.

* Nomenclature after Jessop (1978). Baijnath (1975) establishes that the correct name is *C. involucratus* Rottb.

Black's (1919) concluding comment of his discussion of the species was that it "is a Mediterranean plant, but it is doubtless native here". However, that a species is widespread in the interior is no proof that a species is native. Similar cases of plants of Mediterranean origin that are widespread in the interior but rarely found in southern areas are *Glaucium corniculatum* (L.) Rudolph and *Schismus arabicus* Nees among others.

It is possible that the introduction of this plant to the interior may have been associated with the introduction of camels and their drivers. This occurred in the case of *Scirpus hamulosus* (M. Bieb.) Steven which occupies similar habitats in the same region (Blake, 1943).

6. *C. tenellus*

Bentham (1878) unequivocally regarded this species as being native to Australia, South Africa and New Zealand. This was despite the fact that at that time it was only recorded from Parramatta in New South Wales and from Western Australia (two collections by Drummond). Mueller (1874), however, in the first record of this species in the Australian literature had clearly stated "in Australiam occidentalem extratropicam migravit". But even the latest Australian floras — Burbidge & Gray (1970); Willis (1970); Beadle *et al.* (1972) and Jessop (1978) follow Bentham. However, Moore and Edgar (1970) state that it is no longer regarded as indigenous to New Zealand.

Within South Australia it was not recorded by Tate (1880) as being present, but was subsequently recorded for this State by Mueller (1882) and Tate (1890) who recorded it as being present in his region "A" i.e. the Adelaide area. These records must have been based on the following early collections: St Vincent's Gulf, Tate, 1882 (MEL!); Square Waterhole, Tate, 7.i.1882 (AD!); Square Waterhole, along banks of drain, *Tepper 1065,* 4.ix.1882 (MEL!); Government farm (i.e. Belair National Park), 24.ix 1883 (AD!); South Para River, Tepper, 21.x. 1888 (MEL!).

Even today it has three disjunct ranges within South Australia, an area within about 35 km radius of Port Lincoln on Eyre Peninsula, the Adelaide Hills from the Barossa Valley to Cape Jervois and extending onto Kangaroo Island, and scattered records from the lower south-east. This latter range appears to be separated from the nearest Victorian population (Willis, 1970) which is in the Grampians.

It is suggested that this is a South African species which was inadvertently transported from the Cape of Good Hope where it is common (Adamson and Salter, 1950).

7. *C. brevifolius*

This species is native to the islands north of Australia (and beyond) and was collected by R. Brown at Port Jackson and other places on the eastern seaboard before 1805 (Brown, 1810) as *K. monocephala* Rottb. Further collections were made quite widely in the same general area in later years and these are recorded by Mueller (1874) and Bentham (1878). A closely related species native to eastern Australia was also listed by Brown (1810) and Bentham (1878) as *K. intermedia* R.Br. and the latter has appeared presumably erroneously, in the local literature.

In South Australia this species was first recorded by Tate (1880) as *K. monocephala* from his region "M" i.e. Murray. Black's (1943) record of *C. brevifolius* from the River Murray is presumably based on Tate's record. A record of *K. intermedia* from the Adelaide area was given by Tate (1890). No specimens could be found upon which these records were based. There are only three other records and they are from Adelaide; in a lawn at the Waite Institute in 1931 (AD 95519093!), from a couchgrass tennis court at Magill in 1961 (ADW 23628!) and from another Adelaide garden in 1964 (ADW 27826!).

In the eastern States and particularly in the metropolitan areas of the major cities, this plant is an important lawn weed. It may be assumed that if this species did occur locally it would also be found in lawns (as the cited specimens show) and would be a source of concern

or at least curiosity. In other words it is most unlikely to be widespread but not recognized. The conclusion is drawn that this species is not native but is a casual introduction probably from eastern Australia.

8. *C. rotundus* ssp. *rotundus*

The early records of this species were quite similar in respect to location and data as *C. brevifolius*. However early records from Victoria and other southern locations were based on misidentifications particularly of *C. victoriensis* C.B. Clarke and *C. bulbosus* Vahl (Blake, 1942).

This sub-species is not native to South Australia. Early records of Tate (1880, 1890) may be ascribed to ssp. *retzii* in the far north and to misidentifications as mentioned.

The first recorded introduction of *C. rotundus* was as a garden plant into the Botanic Garden in 1884 (Annual Report, 1885). This material was of unspecified "Australian" origin. It seems to have been foolhardy to introduce the plant as it was already known to be a major weed problem in the Sydney Botanic Garden as early as 1858 (Michael, 1972). By 1899 it was recorded (Anon. 1899) that "this weed is frequently introduced with dahlia roots and other plants from New South Wales and Queensland and has already gained a hold in several places in South Australia".

However, a more potent method of introduction was that associated with the cultivation of "groundnuts" or "chuffas". These were the tubers of *Cyperus esculentus* L. which were roasted and nibbled as a snack much as we use peanuts or potato chips. Heyne (1871) was already recommending their growth. A further introduction of material of unknown origin to the Botanic Garden took place in 1879 (Annual Report, 1880) and in 1891 the Central Bureau of Agriculture introduced seed which was distributed to Agricultural Bureaux throughout the State (Anon. 1891). Demand was so great that the Bureau was forced to appeal to members to donate bulbs for further distribution (Anon., 1895). This culinary fad had passed by the first years of the century and plantings were abandoned. It is suggested that due to honest misidentification and a little bit of fraud most of the so-called "*C. esculentus*" that was being circulated was probably *C. rotundus*. This was most likely in the last years of the century when demand was great. The sudden end to the fad could well have been caused by just this substitution of species, for, whereas the roasted tubers of *C. esculentus* are sweet and apparently appetizing, those of *C. rotundus* are bland and starchy. Certainly, regardless of what was being planted as *C. esculentus*, only *C. rotundus* has survived.

The end result was that the abandoned plantings died out where there was no permanent water over summer, but along creek beds and other favoured places, the plant persisted and in places thrived. Half a century later, those same places were turned into loam pits for the Adelaide metropolitan area. This has resulted in the widespread movement of this difficult weed to gardens, particularly newer ones, throughout the Adelaide area. In the older suburbs, populations may be remnants of original plantings.

9. *C. sanguinolentus*

The early records of this species were from the same areas as those of *C. brevifolius* with an anomalous record from South Australia collected by Mueller in 1847 in the "Mt. Lofty Range, near the source of (River) Torrens" (MEL!). It was recorded by Bentham (1878) as *C. eragrostis* Vahl. Mueller (1874) had earlier referred to this species but his synonymy differs from that of Bentham. Apart from taxonomic uncertainty, the habit of the plant is also confused in the literature. Bentham (1878) described it as a perennial and he was followed by Ewart (1930) and Willis (1970). However the South Australian material is recorded as annual (Black, 1943 Jessop, 1978) which is also the finding of Burbidge and Gray (1970). Clarke (1884) in his major study of the genus records it as an annual. The apparent contradiction may be due to flowering in the first year (Bentham. 1878; Beadle *et al.*. 1972).

Black (1922) noted Mueller's record but stated that it did not appear to have been found since in South Australia. Since 1921 it has been collected intermittently from four locations (of which two may be the same place). These are "Encounter Bay" where it was first collected by J.B. Cleland in 1921 (AD 966040854!) and "swamp north of bluff, Encounter Bay" where it was also collected by Cleland in 1933. It was also collected in a swamp in Cleland's Gully, Tooperang, near Mt. Compass in 1926, 1939 and 1942. The identity of the 1939 specimen was determined by S.T. Blake (Black, 1940). More recently, in 1968, a further collection was made in a swamp at Yundi which is also near Mt Compass. All these sites are within 25 kilometres of each other.

It is concluded that this species is not native to South Australia. It has been introduced from the eastern States or from overseas, at different times and seems to persist for only short periods. Its introduction may be associated with the movement of cattle from the eastern States as its stations in this State including Mueller's, are all swampy areas that have been grazed by cattle. The status of this species is difficult to determine and a detailed study would undoubtedly throw more light on the natural range of this difficult species, whose growth habit is not even known with certainty.

10. *Cyperus* sp.

Eight collections of this species in AD, previously determined as *C. laevigatus* have been made from the Picanninie Blue Lake near Mt Gambier, in 1963 (3 specimens), 1972 and 1974, from Salt Creek, on the Coorong in 1974 and from near Encounter Bay in 1926 and 1934. It has some morphological features in common with *C. laevigatus* such as the terete stems and colouring on the glumes. However, whereas *C. laevigatus* only has one or occasionally two spikelets, this species has clusters of up to twelve spikelets. I leave the identification of this species to a specialist in the genus, after which its status may be assessed.

Conclusions

In the preceding discussion, continuity of range has been accorded cardinal importance in assessing each species' status as a native or an exotic. Where the distribution of a species of *Cyperus* in Australia is merely an extension of a general range from the islands to the north of the continent, it is concluded that its occurrence here is not dependent on the activities of man, particularly of Europeans. Such species are tropical species, which in Australia may extend into the eremaean zone including the northern regions of South Australia. A continuous environment permits a continuous range.

However, in contrast to its tropical regions, temperate Australia is completely isolated from other temperate areas — from those in the northern hemisphere by the tropics and sub-tropics and from those in the southern hemisphere by the oceans. This isolation has existed since the early Tertiary, about 40-50m years B.P (Schuster, 1976; Thorne 1978). So in this case, identical populations occurring disjunctly in Australia and overseas could only have arisen as relics of a former continuous population that existed before isolation or as a result of long-range dispersal.

The possibility that a species already developed before isolation could maintain identical populations in two eventually distant locations which were subject to quite different environmental conditions over a very long period is considered to be negligible. Similarly, the chance that even a common ancestor, since disappeared, could give rise to disjunct populations of identical species in spite of the great differences in environmental conditions over the vast time scale is also concluded to be negligible. Raven (1971) has reached similar conclusions in his discussion on the evolution of the respective floras of the areas of Mediterranean type climate throughout the world.

So by rejecting the possibility of the occurrence of natural disjunctions of species from temperate Australia to other temperate regions, it is possible to reassess the status of the South Australian *Cyperus* species as follows:

Native to South Australia

1. Extra-Australian
   C. bulbosus, C. difformis, C. exaltatus, C. iria, C. pygmaeus, C. rotundus ssp. *retzii* and *C. squarrosus.*
2. Endemic to northern Australia (and adjacent areas)
   C. clarus, C. cunninghamii, C. dactylotes, C. gilesii, C. rigidellus and *C. victoriensis.*
3. Endemic to southern Australia (and adjacent areas).
   C. gunnii, C. gymnocaulis, C. rutilans and *C. vaginatus.*

Introduced to South Australia

1. Native to the tropical eastern Australian coast
   C. brevifolius, C. rotundus ssp. *rotundus* and *C. sanguinolentus*
2. Introduced to Australia
   C. arenarius, C. congestus, C. eragrostis, C. flabelliformis, C. laevigatus and *C. tenellus.*

A similar approach was used in assessing the status of Australian species of the family Brassicaceae (H.J. Hewson, *in litt.)* and it will probably be useful for other species also. It is suggested that where there is an apparent disjunction overseas at the species level, there has either been a misidentification, or the plant is introduced. Many examples of the former situation are available where Australian endemics were originally misidentified, usually as European plants, which gave rise to apparent disjunctions. The correct determinations made in later years disposed of the problem. Some examples are:- *Lepidium ruderale* L. in error for endemic *Lepidium* spp. *Geranium dissectum* L. in error for *G. pilosum* Forst., *Typha angustifolia* L. in error for *T. orientalis* C. Presl. and *T. domingensis* Pers., *Tragus racemosus* (L.). All. in error for *T. australianus* S.T. Blake and *Glyceria fluitans* (L.) R. Br. in error for *G. australis* C.E. Hubbard. The other case, where introduced plants were formerly considered to be native, was briefly discussed earlier.

Where species occur naturally in other parts of Australia, it is more difficult to decide as to their status in disjunct local populations. However, with the *Cyperus* species considered here, it is noticeable that their South Australian distributions and habitats differ from those of their apparently natural range. They may be less common, of known introduction or occupying only one or very few of the range of habitats in which it is found elsewhere. This is in contrast to the relic disjunctions discussed by Crocker and Wood (1947) and more recently by Randall and Symon (1977) where isolated occurrences of a number of species are associated with isolated areas of similar environment. The time spans involved here are only a fraction of those involved in the isolation of the Australian continent. Randall and Symon concluded that the relic populations, now separated by the desert sands of Central Australia were part of a single population only 30 000 years ago. Yet even in that time two populations of *Acacia* have diverged to such an extent that they are regarded as separate species: *Acacia sowdenii* Maiden and A. *loderi* Maiden. This further supports the earlier contention that it would be inconceivable that over the longer period since the separation of Australia from the primordial land mass that any species could develop to become, or remain, identical to another population in another continent.

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FOUR NEW SPECIES OF *CYPERACEAE* FROM CENTRAL AUSTRALIA

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Abstract

Four new species, viz. *Eleocharis papillosa, Fimbristylis ammobia, F. eremophila* and *Shoenus centralis* are described from central Australia.

The author is currently preparing a monograph of the family Cyperaceae (excluding *Cyperus*) for the proposed Flora of Central Australia. Four distinct undescribed species were known to occur in the area and are described here so that they can be included in the Flora. It is usually considered unwise to describe new species unless one has critically examined all other closely related species. However, the genus *Fimbristylis* is currently under revision by the author and will be covered more fully in a future publication. The other two species, although both occurring in genera in need of revision, are considered to be quite distinct and should not be confused with any other Australian species.

1. Eleocharis papillosa Latz, species nova.

Herba annua nana 3-9 cm alta. Apex vaginae truncatus vel attenuatus plus minusve. Spiculae multiflorae dense. Glumae 2.0-2.5 mm longae. Stamina tria. Stylus trifidus. Nux ovoidea, trigona, acuta papillis tenuibus nitentibus vestita dense, 0.7-0.8 mm longa. Setae 6, nucem fere aequantes vel reductae (absentes raro).

Holotypus: P.K. Latz 5604, 3.vi.1974, Stirling Swamp, 21° 47′ S., 133° 43′ E. Rare in clayey loam, above waterline of seasonal swamp (NT54462).

Isotypi: AD, BRI, CANB, NSW, PERTH, K. L, NY.

Dwarf annual with brownish fibrous roots. *Stems* tufted erect, terete but obscurely striate, smooth, 3-9 cm long by 0.25-0.3 mm wide. *Sheaths* membranous appressed, purplish at base, longitudinally striate, the orifice of the uppermost truncate or somewhat attenuate on one side. *Spikelets* linear-cylindrical to somewhat avoid, somewhat obtuse, about 15-50 flowered, reddish brown to brown, 4-10 x 2.0-3.5 mm. *Glumes* membranous, appressed or obliquely spreading, broadly ovate, obtuse, scarcely keeled, 1 nerved, keel yellowish, sides tinged with purple, 2.0-2.5 x 1.3-1.5 mm, only the lowermost shorter or empty (others all perfect). *Stamens* 3, anthers linear, 1.0-1.5 mm long, with a minute setaceous appendage. *Style* trifid. *Nut* ovoid to acutely trigonous, densely clothed with fine glistening papillae, yellowish brown, 0.7-0.8 mm long and 0.5-0.7 mm wide (excluding the style base), the external cells minute. *Style base* glabrous, variable in shape, from subglobular to subcylindrical, up to 4 mm long and 2 mm wide. *Bristles* 6, white to straw coloured, minutely scabrous, nearly as long as the nut or reduced (rarely absent). (Fig. 1).

Specimens examined

NORTHERN TERRITORY: *Latz 5851,* 4.xii.1974, Ilparpa Swamp, Alice Springs, 23° 45′ S., 133° 50′ E., (BRI, NT). — *Latz 6795* 15.vi.1977, Andado Stn, 25° 10′ S., 135° 36′ E., (AD, NT).

Eleocharis papillosa can be separated from all other Australian species by its characteristic papillose nut. Although the two paratypes are somewhat immature they match the isotype well. The characteristic papillae, although underdeveloped, are still plainly visible on the immature nuts.

E. papillosa is apparently widespread in central Australia but it has probably been overlooked in the past because it is such an inconspicuous, short lived species.

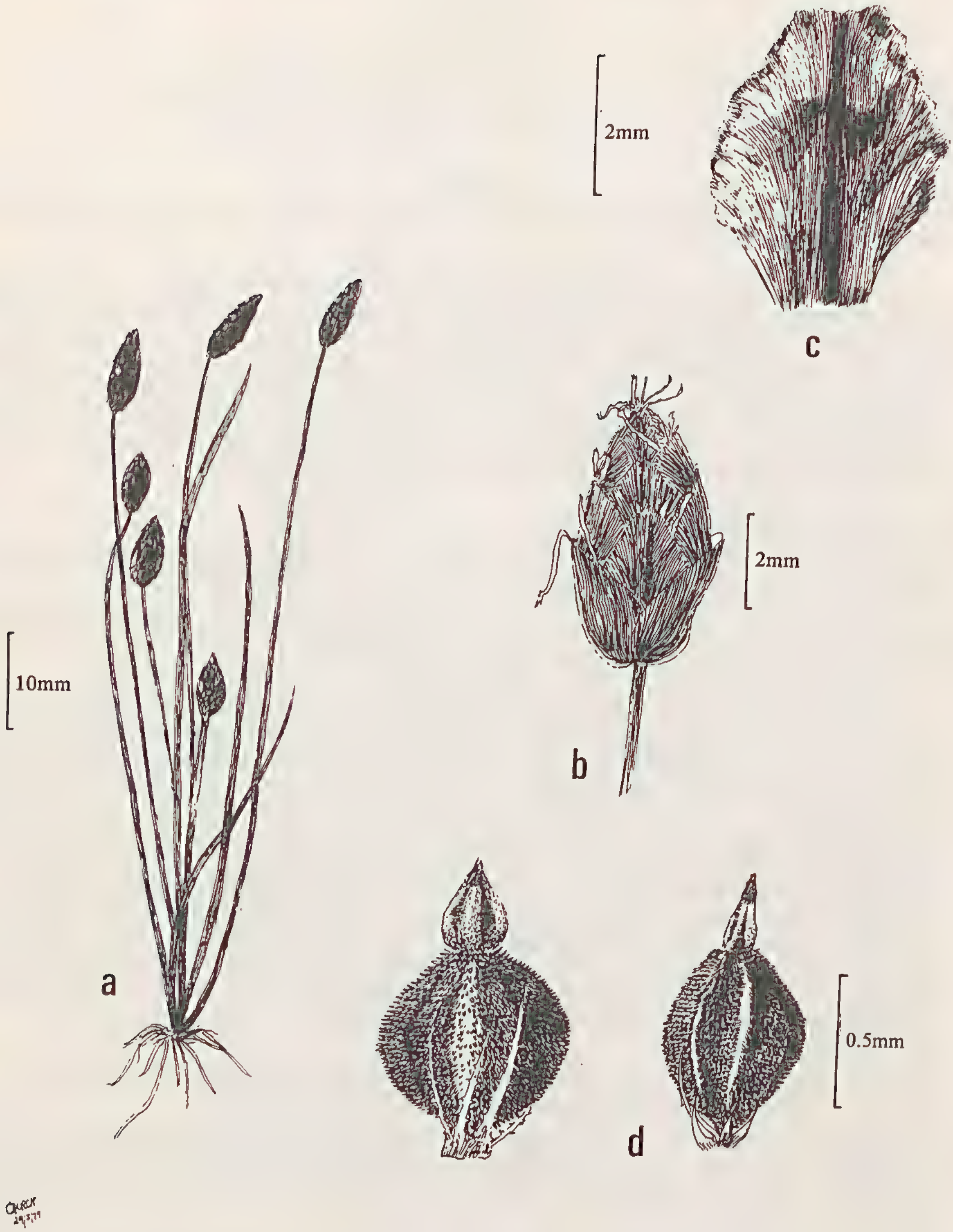

Fig. 1. *Eleocharis papillosa* a. habit; b. spikelet; c. glume; d. nuts. (From *Latz 5604.)*

2. **Fimbristylis ammobia** Latz, species nova.

Glabra annua usque 20 cm alta, foliis angustis brevibus. Ligula absens. Inflorescentia plerumque singularis terminalis spicula, rariore 1(-2) pedunculatis lateralibus spiculis. Spiculae 3-15 x 2-5 mm. Fertiles glumae 2.5-3.5 mm longae, mucronatae breviter. Staminae 3. Stylus 0.7-1.5 mm longus glaber, basi bulbosus. Stigmata 3. Nux ovoidea vel ovoidea-oblonga 1.0-1.5 x 0.8-1.0 mm, 3 nervatis inconspicuis, transversalibus cristis.

Holotypus: P.K. Latz 5960, 26.v.1975, Singleton Station, 20° 47 ′ S., 134° 13′ E. Erect annual becoming pinkish with age. Infrequent in red sand, edge of depression (run on area) with *Triodia pungens* and *Eucalyptus microtheca* (NT48474).

Isotypi: — AD, BRI, CANB, MEL, NSW, PERTH, K, L, MO.

Small, glabrous annual with fibrous roots. *Stems* erect and spreading, striate, smooth or slightly scabrid above, leafy at the base, up to 20cm long and 0.4-1.0mm wide, sometimes much reduced. *Leaves* basal, mostly reduced to bladeless sheaths, those produced rarely half as long as the stems, margins usually inrolled, scabrid above; about 0.3mm wide; ligule absent, sheaths with broad hyaline margins. *Inflorescence* usually a single terminal spikelet more rarely 1(-2) peduncled lateral spikelets added. Involucral bracts 1-2, glumelike, mucronate, only slightly longer than the glumes. *Spikelets* solitary, ovoid, angular, obtuse, several flowered, pale yellow, 3-15 x 2-5mm; rachilla winged. *Glumes* spiral, broadly ovate, obtuse or apiculate, keeled, 2.5-3.5 x 2.0-2.5mm, stramineous with 3 nerved keel nerveless sides and narrow hyaline margins. *Stamens* 3, anthers oblong, 0.7-1.5mm long. *Style* glabrous, with large bulbous base, 0.7-1.5mm long; stigmas 3, about as long as the style. *Nut* obtusely trigonous, ovoid to ovoid-oblong, inconspicuously 3-nerved, with convex side, minutely stipitate and umbonulate, marked with 7-10 coarse transverse ridges, whitish or stramineous, 1.0-1.5 x 0.8-1.0mm. (Fig. 2)

Specimens examined

NORTHERN TERRITORY: *Chippendale s.n.*,NT1162, 11.v.1955, 24 km E Argadargada Homestead, 21° 40′ S., 136° 52′ E., (BRI, CANB, NT) — *Latz 5556,* 22.vi.1974, 3 km N. Taylors Well, Stuart Hwy, 21° 13′ S., 134° 08′ E., (BRI, CANB, NSW, NT, NY, PERTH) — *Latz 6037,* 1.vi.1975, McLaren Creek Stn, Frying Pan Waterhole, 20° 18′ S., 133° 55′ E., (CANB, NT) — *Latz 7000*, 9.v.1977, Elkedra Stn, Aranju Waterhole, 21° 11′ S., 135° 47′ E. (BRI, MEL, NSW, NT) — *Latz 7045,* 11.v.1977, Annitowa Stn, 21° 04′ S., 136° 28′ E. (BRI, DNA, NT) — *Latz 7054,* 12.v.1977, N. Annitowa Stn, 20° 21′ S., 136° 46′ E. (NT, K, L) — *Latz 7084*, 12.v.1977, 3 km W. Frewena Roadhouse, 19° 26′ S., 135° 23′ E. (AD, CANB, NT, PERTH).

WESTERN AUSTRALIA: *Latz 4039,* 20.vii.1973, N. Balgo Mission, 19° 43′ S., 128° 18′ E. (BRI, CANB, DNA, MEL, NT, PERTH, K, L).

The first two specimens seen, viz. *Chippendale s.n.* and *Latz 4039* were originally identified by the author as *F. subaristata* Benth. (ex description). However, on examination of specimens of true *F. subaristata* it was immediately apparent that *F. ammobia* was a distinct species. *F. subaristata* has acute, often aristate glumes, the nuts are larger, distinctly 3 nerved and lacking distinct transverse ridges and single terminal spikelets are rarely seen. *F. punctata* R.Br. has close affinities to *F. ammobia* but differs by being larger in all parts and by its flattened ciliate style.

F. ammobia appears to be restricted to far northern areas of central Australia where it occurs in red sand with *Triodia,* usually near (but well above) watercourses and seasonal swamps. In the west of its known range it is often associated with the peculiar white trunked form of *Eucalyptus microtheca.*

3. **Fimbristylis eremophila** Latz, species nova.

Perennis foliosa glabra. Distincta ligula absens. Inflorescentia composita. Spiculae 6.0-13 x 1.0-1.5 mm rubrifuscae, oblongae vel lanceolatae. Glumae fertiles 2.0-2.5 mm longae, obtusae, mucronatae, marginibus ciliatis saltem ad apicem. Stamina 3. Stylus dense ciliatus supra, 1.0-1.3 mm longus, basi bulbosus. Stigmata 3. Nux alba, 0.8-1.0 x 0.4-0.6 mm, obovoidea verrucosa.

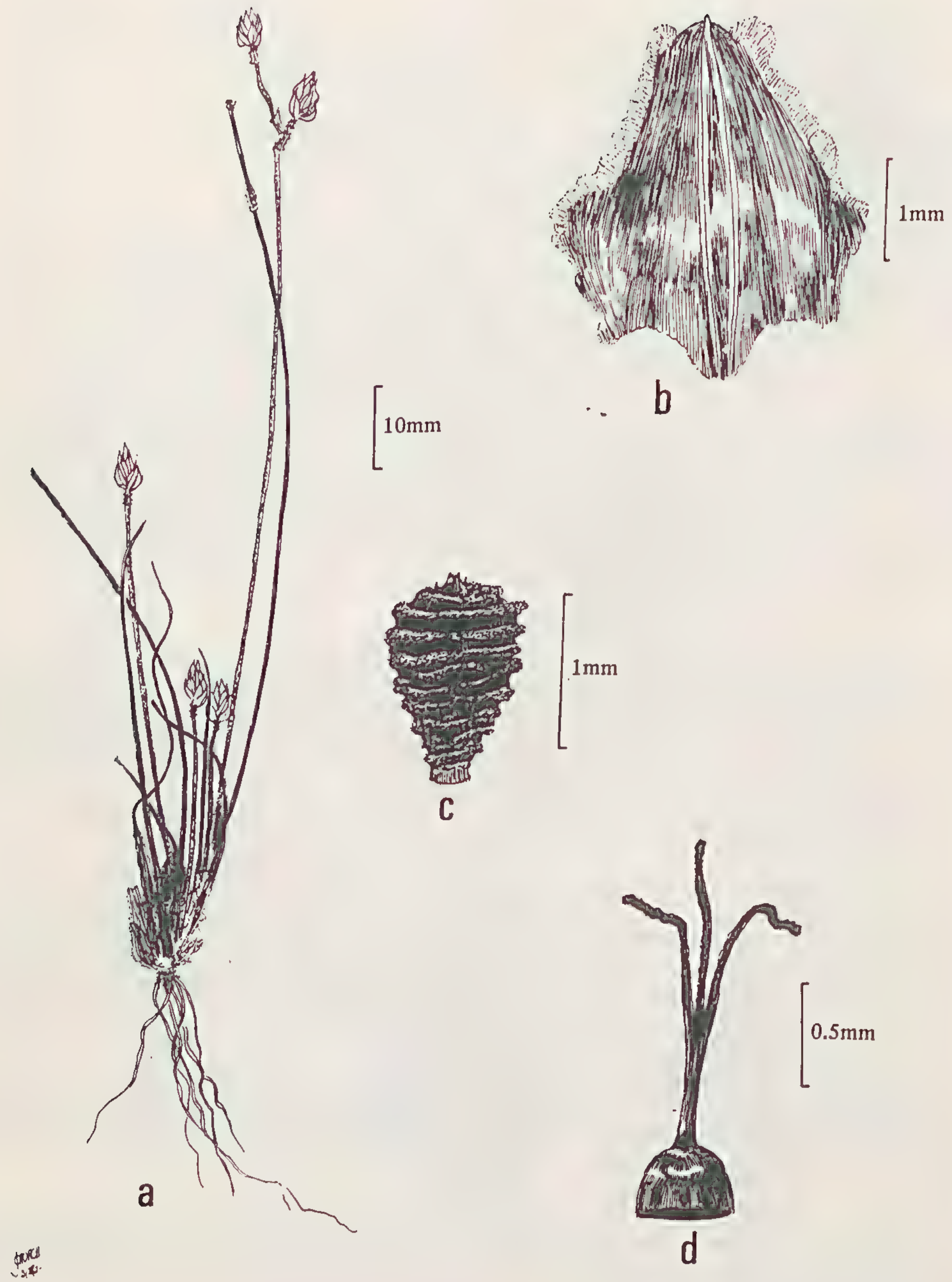

Fig. 2. *Fimbristylis ammobia* a. habit; b. glume; c. nut; d. pistil. (From *Latz 5960.)*

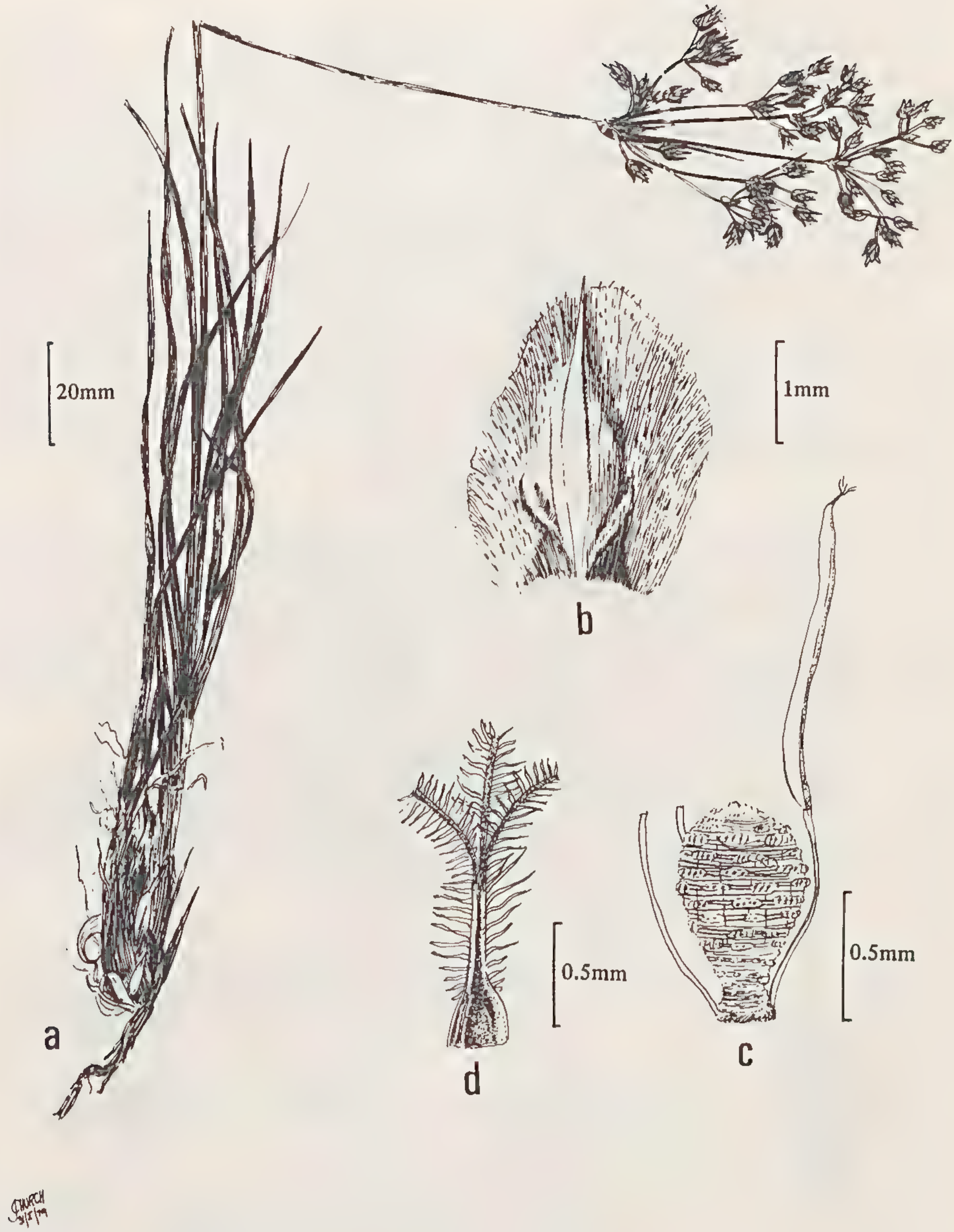

Fig. 3. *Fimbristylis eremophila,* a. habit; b. glume; c. nut and stamen; d. pistil. (From *Latz 2101.*)

Holotypus: P.K. Latz 2101, 18.i.1972, Mt Gurner 22° 43′ S., 130° 42′ E. Large erect perennial. Locally common in sandy loam at base of quartzite hill. Recently burnt *Triodia pungens* community (NT34183).

Isotypi: AD, BRI, CANB, NSW, PERTH, K, L, MO.

Glabrous perennial with short rhizome. *Stems* densely tufted, rigid, striate, several leafed at the base, 25-58 cm x 0.5-2.0 mm. *Leaves* shorter than the stems, rather rigid, flat or inrolled, margins scabrid gradually tapering to the acute apex, greyish green; no distinct ligule. *Inflorescence* decompound, loose to somewhat dense with numerous spikelets (20-140) up to 7 cm by 7 cm. Involucral bracts 3-5, erect, the lowest sometimes overtopping the inflorescence 2.5-6.5 cm long, scabrid. Primary rays 5-11, striate, scabrid above, up to 5 cm long. *Spikelets* mostly solitary but sometimes in clusters of 2-4, oblong to lanceolate, acute, becoming twisted with age, several to many flowered, reddish brown, 6-13 x 1.0-1.5 mm; rachilla broadly winged. *Glumes* spiral sometimes subdistichous, oblong-ovate, acute or apiculate, keeled 2.0-2.5 x 1.5-2.0 mm, keel green, 3 nerved, sides nerveless, ferrugineous to brown, the hyaline margins minutely ciliate at least on the upper margins. *Stamens* 3, anthers oblong 1.0-1.5 mm long with a minute setaceous appendage. *Style* triquetrous, usually with a bulbous base, densely long ciliolate above rarely glabrous at the base, 1.0-1.3 mm long; stigmas 3. *Nut* 3 nerved obtusely trigonous, obovoid to ellipsoid, shortly stipitate, umbonulate, verruculose to almost tuberculate, finely transversely lineolate by the oblong-linear epidermal cells, white, 0.8-1.0 x 0.4-0.6 mm. (Fig. 3)

Specimens examined

NORTHERN TERRITORY — *Latz 1212,* 14.i.1971, Red Bank bore, Coniston Stn, 21° 56′ S., 132° 25′ E. (BRI, MEL, NT, NY, PERTH) — *Latz 1988,* 13.i.1972, SW. Yuendumu, 22° 28′ S., 131° 29′ E. (AD, BRI, CANB, NT) — *Latz 2062,* 15.i.1972, Mt Doreen Stn, 22° 27′ S., 130° 41′ E. (NT, K.L.) — *Latz 4045,* 21.vii.1973, 80 km W. Tanami, 19° 52′ S., 129° 03′ E. (NT, PERTH) — *Latz 5550,* 21.vi.1974, 4 km E. Wycliffe Well, 20° 47′ S., 134° 16′ E., (CANB, NT) — *Latz 5736,* 23.ix.1974, 9 km S. Mt Currie, 25° 06′ S., 130° 34′ E. (AD, BRI, NSW, NT, PERTH, L) — *Latz 6578,* 9.viii.1976, Tanami Sanctuary, 21° 39′ S, 131° 05′ E, (NSW, NT) — *Latz 7019A,* 10.v.1977, Annitowa Stn, 21° 07′ S., 136° 17′ E. (BRI, NT) — *Latz 7082,* 13.v.1977, 3 km W. Frewena Roadhouse, 19° 26′ S., 135° 23′ E, (BRI, DNA, NSW, NT, PERTH) — *Beauglehole 50856,* 19.v.1976, Tanami Desert, 20° 35′ S., 130° 21′ E., (NT) — *J. Wauchope s.n.,* 6.vii.1977, Ormiston Gorge, 23° 38′ S., 132° 43′ E. (NT).

Fimbristylis eremophila belongs to the Section *Cymosae,* a rather difficult group in Australia. However it can be separated from the other members of this section by its small ciliate, bulbous based style, its small, white, verrucose nut and its perennial habit. It appears to be restricted to northern areas of central Australia where it can be quite common, mostly in association with *Triodia* in better watered sand plain areas.

4. **Schoenus centralis** Latz, species nova.

Planta annua caespitosa. Folia basalia et caulina, plana, uninervia ad marginem incrassata scabra. Inflorescentia racemosa, raro paniculate, ramis floriferis (2-) 3-4(-6). Spiculae 5-7 mm longae, floribus fertilibus, 4-6 omnibus perfectibus. Glumae 6-10; glumae fertiles, carina scabra 2/3 supra. Perianthium destitum. Stamina 3. Stylus glaber, stigmata 3. Nux ovoidea ad obovoideam trigona acute (fere alis) angulibus truncatis abrupte prope apicem, 11-15 mm longa.

Holotypus: P.K. Latz 5945, 9.v.1975, Napperby Stn, 22° 43′ S., 132° 23′ E. Infrequent in gravelly sand at base of quartzite hill; seepage area. With *Melaleuca glomerata* (NT48447).

Isotypi: AD, BRI, CANB, NSW, K, L.

Annual with pink fibrous roots, glabrous except for scaberulous leaf margins and inflorescence. *Stems* densely tufted, weak but usually erect, terete to somewhat flattened, obscurely striate, smooth with 1 or rarely 2 sheaths between the basal sheaths and bracts, (3-) 15-30 cm long by 0.5-0.8 mm wide, the base clothed with 5-nerved, pinkish, open, hyaline margined sheaths produced to a blade up to 5 cm long (sometimes reduced to a short point). *Cauline leaves* 1-2, flat, the upper surface grooved on each side of the central nerve, margins thickened, scaberulous, otherwise glabrous, 1-6 cm long, about 8 mm wide; ligule absent. Sheaths obscurely 5-nerved, tubular, truncate at the apex with a hyaline margin shortly

Fig. 4. *Schoenus centralis* a. habit; b. deflorate spikelet; c. glume; d. nuts. (From *Latz 5945.)*

decurrent onto the leaf blade, up to 2 cm long. *Inflorescence* racemose, rarely sub-paniculate, loose, consisting of (1-) 3-4 fascicles of branches. Solitary bracts similar to the leaves only the uppermost overtopping the inflorescence. Branches (2-) 3-4(-6) together, unequal, spreading, compressed, scaberulous with 1 (rarely 2) spikelets, 0.25 mm wide and up to 2 cm long. *Spikelets* lanceolate to narrow ovate, acute, 4-6 flowered, 5-7 mm long and about 2 mm wide; the uppermost always with 3 empty glumes below the fertile ones. Rachilla flattened dorsally, 3-4 mm wide, lower internodes (between the empty glumes) very short, upper ones elongated and prominently zig-zag at maturity. *Glumes* distichous, 6-10, the lowest 2 or 3 and the uppermost reduced and empty. Fertile glumes membranous, decurrent on the rachilla, lanceolate, rather acute but shallowly notched at the apex, 3-4 mm long; keel green, scabrid on the upper 2/3, sides orange or reddish, nerveless or with one faint nerve in the centre on either side, margins hyaline; spreading at maturity and usually falling with the nut. Lower empty glumes shorter, more acute otherwise similar to upper. *Perianth* absent. *Stamens* 3; anthers yellow, 1.5-2.5 cm x 0.2-0.25 mm, appendage of the connective short, up to 0.5 mm long. *Style* slender, glabrous, 1.5-3.0 mm long; stigmas 3, about 1 mm long. *Nut* sharply trigonous, ovoid to obovoid, the 3 angles acute, almost winged and abruptly truncate near the apex, 1.1-1.5 mm long (including the 0.3-0.4 mm long style base) 0.5-0.6 mm wide, blackish blotched at maturity; epidermal cells isodiametric to oblong in vertical rows, sometimes swollen. (Fig. 4)

The Australian species of *Schoenus* are badly in need of revision. It appears, however, that *S. centralis* can be separated from all the other Australian species by the following combination of characters:—the annual habit; the flat 'grass like' leaves, the presence of up to 6 fertile flowers; the lack of bristles or scales; the scabrid glumes and the shape of the nut. Known only from the type specimen, it appears to be endemic to central Australia and is separated by about 800 km from the nearest *Schoenus* to the north.

Acknowledgements

I wish to thank my colleagues Mr J. Maconochie and Mr A. Mitchell for preparing the Latin descriptions and commenting on the manuscript and Mr P. Sharpe of the Queensland Herbarium for his general help and advice and Mrs J. Church for the illustrations.

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TAXONOMIC ACCOUNT OF *NICANDRA* (SOLANACEAE) IN AUSTRALIA

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Abstract

Nicandra, of which there is only one species, *N. physalodes* (L.) Gaertn., is a native of Peru and has become naturalized in many tropical and temperate regions of the world. In Australia it is a weedy species occurring mainly in cleared or disturbed sites and on cultivated ground, mostly in the eastern coastal region. A description of the species based on Australian material is presented and its distribution in Australia is mapped.

Introduction

Nicandra physalodes, the only species in the genus (family Solanaceae) and native to Peru, has become a well-established member of the Australian flora. It has been cultivated as an ornamental garden plant in Australia and elsewhere, and is now widely dispersed in tropical and temperate areas. *N. physalodes* has been suspected of poisoning stock, but feeding experiments in New South Wales in which the green berries and the plant were tested on sheep and a goat gave negative results (Hurst, 1942). Cohen (1970) documented a case of two ewes having died apparently as a result of grazing in a yard heavily infested with *N. physalodes;* their ruminal contents consisted almost entirely of fragments of *N. physalodes.* The plant is also said to be used as a fly poison (Hurst, 1942), but its poisonous principle is unknown (Everist, 1974), although believed to be an alkaloid (Willaman, 1961). The most recent Australia-wide account of *Nicandra* is that of Bentham (1868) who reported it as occurring only in New South Wales. *Nicandra* has become considerably more widespread since then and occurs, for instance, in South Australia although it is not listed in a flora of this State.

As a continuation of taxonomic reviews of solanaceous genera in Australia currently being conducted at the Herbarium of the Waite Institute, a taxonomic account of *N. physalodes* is presented here. Dried material examined for this study was from the following herbaria: AD, ADW, BRI, NSW and PERTH; material cultivated or adventive at the Waite Institute was also studied.

This plant was described as a species of *Atropa, A. physalodes,* by Linnaeus (1753). Boehmer (1760) and Adanson (1763) recognized it as being distinct from *Atropa* and described the genera *Physalodes* and *Nicandra* respectively to contain it; they did not publish specific epithets. Although *Physalodes* Boehmer antedates *Nicandra* Adans., the latter is conserved (ICBN, 1972, p.356). Gaertner (1791) referred Linnaeus' species *Atropa physalodes* to *Nicandra* Adans., but published it as *N. physaloides.* This spelling has been followed by a number of authors, but the original spelling must be retained (ICBN, 1972, article 62). Schönbeck-Temesy (1972) uses the name '*Nicandera* Adans., Fam. 2:219 (1763) "*Nicandra*"; orth. mut. Cothen., Disp. 21 (1790)'. However, according to the ICBN (1972) articles 62 and 73, the original spelling is not to be changed or "corrected".

The following key separates *Nicandra* from other solanaceous genera in Australia, from most of which it is readily distinguished.

1a. Fruit enclosed in a distinctly inflated calyx 2
1b. Fruit not enclosed in a distinctly inflated calyx .... other genera
2a. Stems and leaves with prickles and stellate hairs .... *Solanum* (A few species)

2b. Stems and leaves without prickles and stellate hairs, almost or entirely glabrous 3

3a. Corolla white or yellow; base of calyx lobes not, or shallowly, lobed or cordate 4

3b. Corolla blue to violet; base of calyx lobes deeply cordate or sagittate .... *Nicandra*

4a. Flowers solitary .... *Physalis*

4b. Flowers clustered .... *Withania*

NICANDRA Adans.

Nicandra Adans., Fam. Pl. 2: 219 (1763) (nom. cons.).
Physalodes Boehmer in Ludwig, Def. Gen. Pl. 41(1760).
Calydermos R. & P., Fl. Peruv. 2:43 (1799).
Alkekengi amplo flore violaceo Feuill., J.Obs. 2:724, pl.16 (1714) (pre-Linnaean phrase name).

Nicandra physalodes (L.) Gaertn., Fruct. Sem. Pl. 2:237(1791) *("physaloides").*
Atropa physalodes L., Sp. Pl. 181(1753) (basionym).
Type citation: "Habitat in Peru. D.B.Jussieu".
Lectotype: LINN 246/3 (Schönbeck-Temesy, 1972) (n.v., microfiche AD!).

Physalis peruviana Mill., Gard. Dict. ed. 8, "PHY" no.16 (1768) (non L.) (fide Dunal, 1852).
Physalis daturaefolia Lam., Encycl. meth. 2:102(1768) (fide Dunal, 1852).
Calydermos erosus R. & P., Fl. Peruv. 2:44(1799) (fide Dunal, 1852).
Physalodes peruvianum (Mill.) Kuntze, Rev. Gen. Pl. 452 (1891) (fide Domin, 1929).
"*Atropa daturaefolia* Thore" (cited by Domin, 1929, in synonymy; in fact Thore (1803) was referring to, and used the name, *Physalis daturaefolia.).*
Nicandra minor hort. ex Fisch. et al., Index Sem. Hort. Petrop. 9:81. (1835) = *N. physalodes* (fide Fischer et al., 1835; Dunal, 1852).
N. brevicorollata Bitter, Beih. Bot. Centralbl. 14:173(1903).
N. macrocalyx Bitter, l.c. :169.
N. nana Bitter, l.c. :171.
N. nebulosa Bitter, l.c. :170.
N. parvimaculata Bitter, l.c. :168.
N. undulata Bitter, l.c. :176.
N. violacea André ex Lemoine, Rev. Hortic. 208(1906).
N. physalodes var. *arbiflora* (author not traced) quoted by Sinha (1951), perhaps in error for *"albiflora"?*
N. physalodes var. *latifolia* Dun. in DC., Prodr. 13:434(1852) "foliis late ovatis majoribus. Ex insula Mauritii".
N. physalodes f. *typica* Dahlgren, Hereditas 5:228(1924) (nom.illeg.)
N. physalodes f. *immaculata* Dahlgren, l.c.

Common Name: "Apple of Peru"

Annual herb with upright, sulcate, glabrous stems, to 2 m high or more. *Leaves* alternate petiolate, narrowly to broadly ovate; *lamina* (2-)4-21(-31) cm long x (1-)2-10(-18) cm wide; *apex* acute to acuminate, rarely obtuse; *base* cuneate to narrowly cuneate or attenuate, rarely obtuse; *margin* usually widely, irregularly and shallowly dentate or sinuate-dentate. occasionally deeply so (rarely cleft), or almost entire; upper laminal surface sparsely to very sparsely covered with short, inflated, eglandular trichomes 2-4 cells long, the basal cell subglobular, lower laminal surface glabrous or nearly so; *petiole* (0.5-)1.5-6.5 (-9)cm long, usually narrowly winged distally to almost terete proximally.

Inflorescence pseudaxillary or rarely interfoliar, flowers solitary, pedicellate and somewhat cernuous; *pedicel* 6-24 mm long (longer in fruit), recurved and sparsely to moderately puberulent (becoming glabrous in fruit). *Calyx* usually glabrous, occasionally sparsely puberulent, 5-lobed; *lobes* (7-)9-20(-22) mm long, ovate, acute to acuminate (rarely obtuse) and often slightly mucronate at the apex, sagittate (occasionally cordate) at the base and often mucronate at the basal tips, lobes mutually adpressed along margins to form longitudinal wings (and also fused along the margins for 1/3(-1/2) their length from basal tips). *Corolla* 5-lobed, broadly campanulate, pale blue to mauve on limb and upper tube, and

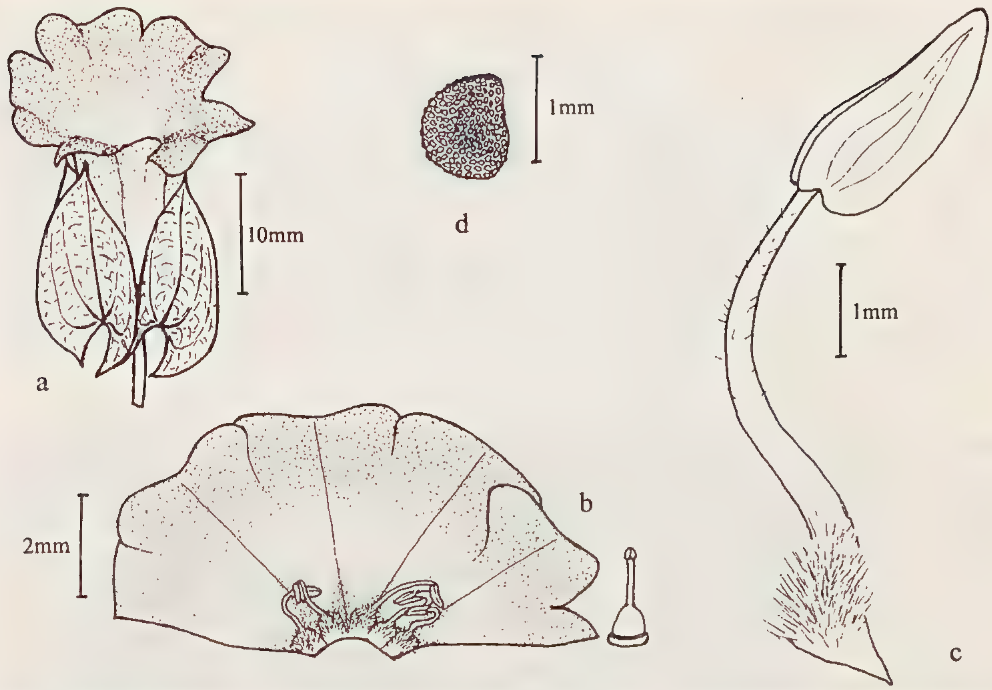

Fig. 1. *Nicandra physalodes.* a) flower; b) opened corolla with stamens, and pistil; c) stamen; d) seed. *(P. Horton s.n.,* ADW 51288).

on lower part of tube whitish with blue spot near base of each lobe; *limb* slightly lobed, plicate in bud; *lobes* alternate with calyx-lobes, 12-23(-30) mm long, 5-15(-22) mm wide, margin usually entire and obtuse, occasionally slightly emarginate. *Stamens* 5, included, alternate with corolla lobes; *filaments* 3-5.5 mm long, inserted near base of corolla tube, densely pubescent on dilated bases; *anthers* yellow, ovate or oblong-ovate with 2 parallel thecae, 1.8-4 mm long, dorsifixed, longitudinally dehiscent. *Ovary* divided (often irregularly) into 3-5 locules; ovules numerous; *disc* hypogynous, flattened, annular; *style* 3-6 mm long, relatively thick; *stigma* capitate with 3-5 prominent stigmatic areas. *Fruit* a globular, pale yellowish, almost dry berry, the outer wall chartaceous and when ripe splitting irregularly at the base (which is usually uppermost in the pendulous fruit),(5-) 11-22 mm diameter, enclosed in the accrescent, chartaceous, reticulate calyx. *Seeds* brown, numerous (in 6 berries counted, the number of seeds ranged from 69 to 638), compressed, subdiscoid to broadly reniform and usually asymmetrically so, 1.2-2.1 mm long, testa reticulate-foveate. (Fig. 1)

Chromosome number

Several authors have obtained the somatic chromosome number 2n = 20 (e.g. Vilmorin & Simonet, 1928; Darlington & Janaki-Ammal, 1945; Venkateswarlu & Rao, 1963). However, the chromosome number still seems to be uncertain, as Darlington & Janaki-Ammal (1945) found it sometimes to be 2n = 19 by loss of one of a pair of isochromosomes; Sinha (1951) obtained counts of 2n = 21 in the variants *"arbiflora"* and *"violacea";* Gill (1971) found the haploid number to be 10 + 1B, and Sharma and Sarkar (1967-68) reported a count of n = 11. No counts based on Australian material have been noted.

Distribution and habitat in Australia

Nicandra in Australia is primarily a summer- and autumn-growing annual and occurs principally in higher rainfall areas of the eastern states, particularly around populous

centres. Most collections of *N. physalodes* have been made from New South Wales and Queensland, with fewer specimens from Victoria, Tasmania, South Australia and Western Australia (Fig. 2). Two of the South Australian collections, *J.M. Black,* 19.v.1932 (AD 97615160) and *B. Frost,* 6.iv.1970 (AD 97015458), are annotated as being adventive in gardens. Likewise at the Waite Institute the species persisted in 1978 around the area where it had been cultivated the previous year. Possibly most or all of the southern and western collections are of plants persisting after cultivation, and can be considered as naturalized in these areas. No collection of *N. physalodes* from the Northern Territory has been located, (none are held at DNA or NT), but Holtze (1892) reported it as having been introduced there. *N. physalodes* grows in a wide variety of soil types, often on the margins of paddocks or amongst pasture or crops such as lucerne, oats, peas and maize, or on cleared or disturbed land. It has been reported as an important pest species in maize crops on the Atherton Tableland in Queensland (Hawton, 1976).

Notes

Bitter (1903) studied *Nicandra* in detail and distinguished a number of different species, listed previously. The characteristics by which he distinguished these species seem to fall within a range of continuous variation normally encountered in *N. physalodes* and to be insufficient to justify specific rank.

N. violacea André ex Lemoine was distinguished from *N. physalodes* by its prominently blue corolla and suffused purple of the calyx, stems, petioles and peduncles, and the scattered coloured hairs on the upper surface of the leaves. Darlington & Janaki-Ammal

Fig. 2. Distribution of *Nicandra physalodes* in Australia.

(1945) consider that this variation does not constitute a distinct species, and suggested, as did Bailey (1943), that it may be merely a variety or variant of *N. physolodes.* It may be no more than a variant with well developed anthocyanin pigment.

Darlington & Janaki-Ammal (1945) considered that *N. physalodes* f. *immaculata* Dahlgren (which lacks the corolla spots) is merely a simple genetic variant, similar to two additional variants which they listed: *violacea* (corresponding with *N. violacea* André ex Lemoine) and *alba* (with white instead of blue flowers). There is no evidence to suggest that any of these form stable populations or have a geographical basis.

Recent authors (often flora-writers such as Gentry & Standley, 1974, and MacBride, 1962) consider the genus *Nicandra* to be monotypic, and in the absence of a monographic treatment since that of Bitter (1903) this view is followed here. Most recent authors also do not recognize varieties or forms of *N. physalodes.*

Of the Australian specimens seen, only one is distinct *(R. Coveny 6574,* annotated: ". . . stems violet, fruit calyx papery and violet-coloured at base"); it corresponds with Bailey's (1943) concept of *"N. violacea* André". However, in all other characteristics it resembles the other specimens seen, and its separation as a distinct species or even variety seems unjustified; it appears to constitute nothing more than a variant, such as Darlington & Janaki-Ammal (1945) proposed. No other Australian specimens are distinct, therefore they are all considered to be *N. physalodes.* This lends support for current considerations of *Nicandra* as a monotypic genus.

N. physalodes in Australia corresponds closely in morphology with its representatives in other countries, according to descriptions of the latter such as in MacBride (1962), Gentry & Standley (1947), etc. The only exception appears to be in the dimensions of the flower, which on average are slightly smaller in Australian specimens. As in other regions, the species in Australia is very variable in morphology. For instance, in cultivation, individual plants have matured when only about 10 cm high whereas others grow to more than 2 m. The leaf dimensions vary in proportion with the size of the plant and as in a number of solanaceous plants the juvenile leaves may be very large and lush when compared with leaves on distal flowering branches. This range in leaf size is rarely represented in herbarium specimens. The degree of variability shown by *N. physalodes* is common in widely spread weedy species (such as *Chenopodium album* L., *Solanum americanum* Mill. and *Sonchus oleraceus* L.) and like these *N. physalodes* is adaptable to many different environments.

Selection of Specimens (Total Seen: 76)

QUEENSLAND: *J.G. Chinning s.n.*, Mount Beagle, Dec. 1916 (BRI 230771); *L. Durrington 492,* Serpentine Creek and environs, ca. 11 km N.E. of Brisbane, Jan. 1973 (BRI); *J.M. Swan 130,* Kuranda Railway Station, Aug. 1974 (ADW); *D.E. Symon 4749,* near Tolga, 17.v.1967 (ADW, BRI); *C.T. White s.n.*, Gatton, 7.v.1925 (BRI 230772 and 230773); *R.W. Williams B63,* "Bilarabyn", Veresdale, 8.ii.1965 (BRI).

NEW SOUTH WALES: *D.F. Blaxell 1335,* Dr George Mountain, 20.iv.1974 (NSW); *J.L. Boorman s.n.*, Jerseyville, Macleay River, June 1910 (NSW 141341); *E. Breakwell s.n.*, Moruya, Dec, 1913 (NSW 141327); *S. Chadwick s.n.*, Scone, Jan 1931 (NSW 141325); *J.B. Cleland s.n.*, Kendall, 13.v.1917 (AD 97548386); *R.G. Coveny 6574,* Elderslie & Branxton roads junction, 1 km E-S-E. of Elderslie, 12.vi.1975 (ADW, BRI); *F. Duguid s.n.*, Narrabri, Jan. 1922 (NSW 141324); *J.J. Fletcher s.n.*, Elizabeth Bay, Sydney, 30.v.1890 (NSW 141337); *T.G. Hewitt s.n.*, Lismore, May 1912 (NSW 141342); *L.A.S. Johnson & B.G. Briggs s.n.*, Yarramundi Lagoon, 2.5 miles (ca. 4 km) S-S-W. of Richmond, 22.x.1966(NSW 141335); *E.N. McKie s.n.*, Llangothlin, 20.iv.1941 (NSW 141326); *F.A. Rodway 6543,* Pyree, Shoalhaven River flats, 2.vii.1933 (NSW); *H. Wenholz s.n.*, Grafton, March 1914 (NSW 141338).

VICTORIA: *Department of Agriculture s.n.*, Bruthen, s.d. (MEL, n.v.); *F.M. Reader s.n.*, Warracknabeal, 11.ii.1904 (MEL, n.v.); *H.S. Wheeler s.n.*, Neerim, Gippsland, 12.ii.1912 (MEL, n.v.).

TASMANIA: *L.V. Lester Garland s.n.*, Lagana, Jan. 1931 (K, n.v.).

SOUTH AUSTRALIA: *J.M. Black s.n.*, Unley, Adelaide, 19.v.1932 (AD 97615160); *Department of Agriculture 500,* Millicent, 13.iv.1964 (ADW); *B. Frost s.n.*, Bethel, 6.iv.1970 (AD 97015458); *W.E. Johnston s.n.*, Port Lincoln, 22.xi.1949 (ADW 6293).

WESTERN AUSTRALIA: *Mrs Austin s.n.*, Middlesex, Mar. 1964 (PERTH); *J.N. Hutchinson s.n.*, Carnarvon, Sept, 1965 (PERTH); *S. Wilkes s.n.*, Busselton, Feb. 1969 (PERTH).

Nomina Exclusa

Nicandra amara (Aubl.) J.F. Gmelin, Syst. Nat. 2 : 677 (1791) = *Potalia amara* Aubl. (Potaliaceae) (fide Dunal, 1852).

N. indica (Lam.) Roem, & Schult., Syst. 4:682 (1819) (basionym *Physalis indica* Lam., Encycl. meth. 2:102 (1786)). Dunal (1852) considered this to be a species of *Physalis (P. minima* L.) Neither Lamarck nor Roemer & Schultes describe the corolla of this species, this being unknown to them, but from their descriptions of the remainder of the plant, it is likely to be a species of *Physalis.*

N. anomala Link & Otto, Ic.Pl. Sel. 77, t.35 (1828) = *Scopolia lurida* Dun. (fide Dunal, 1852). From Link & Otto's description, this species appears to belong to the genus *Scopolia,* not *Nicandra.*

Acknowledgements

My gratitude is extended to the curators of herbaria who arranged for material to be sent on loan or who made available the facilities of their institutions. Special thanks are given to Mr D.E.Symon who offered valuable guidance and advice throughout the course of this study. Thanks also to Mr P.M. Kloot for obtaining for me the collection data of *Nicandra* specimens held at the National Herbarium of Victoria, Melbourne.

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A PUTATIVE HYBRID BETWEEN *PRASOPHYLLUM ARCHERI* AND *P. DESPECTANS* (ORCHIDACEAE)

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Abstract

A putative natural hybrid between *Prasophyllum archeri* Hook.f. and *P. despectans* Hook.f. is reported from Glencoe, South-Eastern region, South Australia. The differences between the putative hybrid and its parents are tabulated and illustrated.

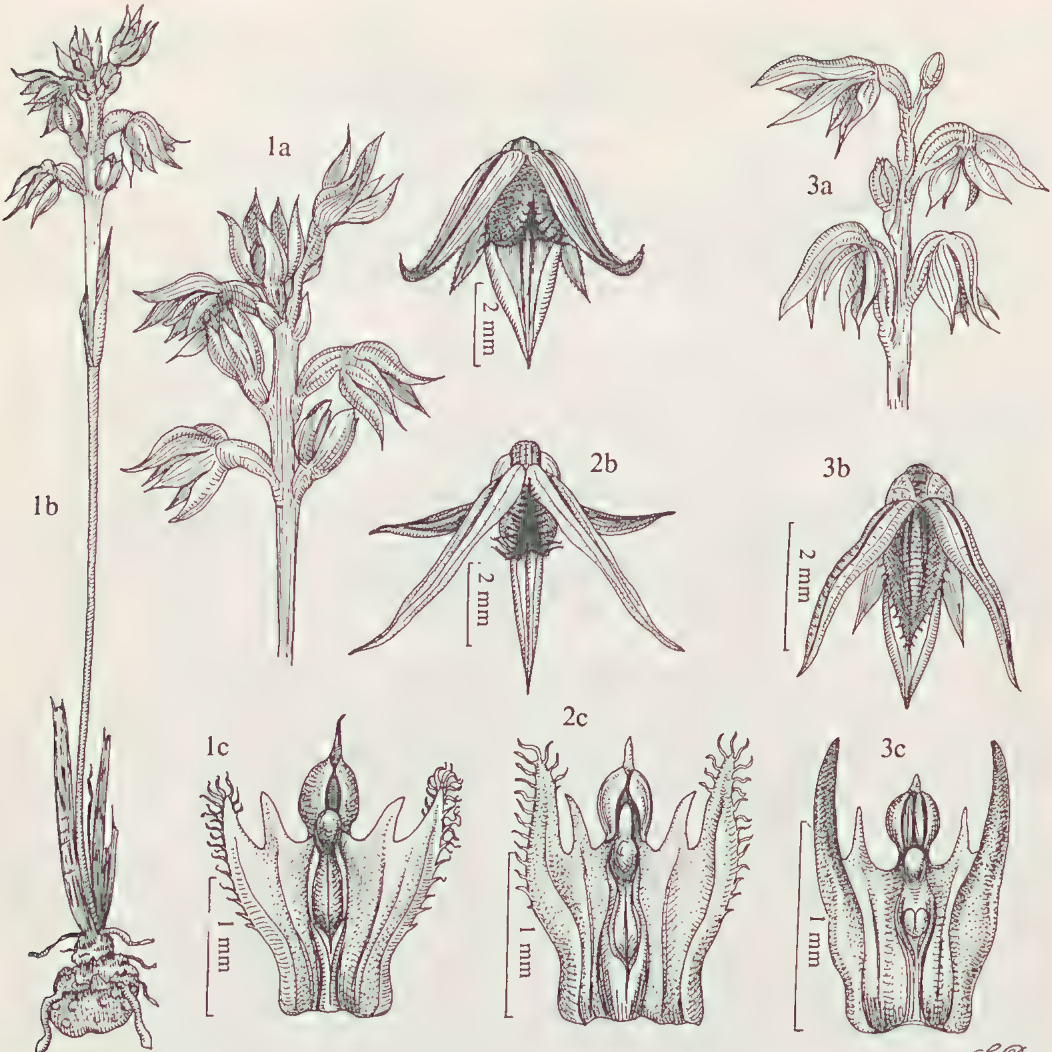
Plants with many morphological characters intermediate between *P. archeri** Hook.f. (1858) (syn. *P. intricatum* Stuart ex Benth., 1873, *P. ciliatum* Ewart & Rees, 1912) and *P. despectans** Hook.f. (1858) (syn. *P. brachystachyum* sensu A.J. Ewart, 1931, non Lindl., 1840) were collected with these species by R. Bates near Glencoe at Honan's Scrub,Woods & Forest Department Reserve (37° 42′ S; 140° 37′ E) on 15 April, 1976, and again in April 1977 and 1978.

Both species are commonly and widely distributed through some 50 hectares of bush, occurring predominantly in leached sands on the margins of swamp and flowering most profusely in areas burnt the previous spring. The incidence of heavy rains affects the flowering times of both species, especially *P. archeri* which may flower earlier following heavy rains in late summer. Both species are usually found in association with *Xanthorrhoea australis* R.Br. (grass tree).

P. archeri occurs in South Australia in the Southern Lofty and South-Eastern regions and in all eastern Australian States, flowering from mid-March through May in South Australia and western Victoria. Its height varies from 5 to 25 cm and inflorescences contain 2 to 15 flowers: the voucher specimen is 15 cm tall and has 7 flowers. *P. despectans* is presently known in South Australia from a single locality in the South-Eastern region. Due to the diminutive size of both *P. archeri* and *P. despectans* it was not until 1970 *(P. archeri)* and 1976 *(P. despectans)* that the species were first collected in the South-East, but it is likely that they were widespread in the region before extensive destruction of habitat. *P. despectans* occurs elsewhere; in south-eastern New South Wales, is widespread through western Victoria and Tasmania and flowers from mid-February through April in South Australia and western Victoria. Its height varies from 5 to 20 cm and inflorescences have few to many (-40) flowers: the voucher specimen is 7 cm tall and has 3 flowers. The putative hybrid voucher specimen is 10 cm tall and has 4 flowers. Both species are visited by the same insect species, identified at the South Australian Museum as a drosophilous fly *(Chloropidae)*.

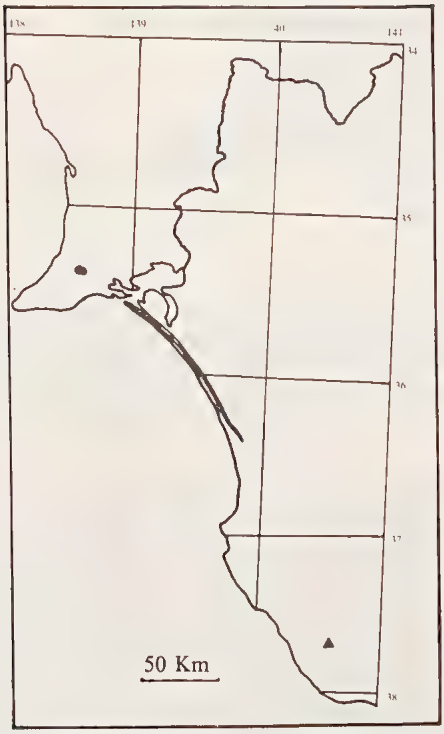
Only six specimens of the putative hybrid have been collected over three years, partly because the extremely small size of the plants makes detection and identification in the field difficult. No evidence of back crossing was found and the absence of mature capsules may suggest infertility in the hybrid. The authors have found no other evidence of hybridization between species of *Prasophyllum* in the literature. The absence of intermediates between the putative hybrid and parents makes it improbable that the hybrid is a phenotypic product of local variation in environmental conditions.

* Identification of the parent species accords with current literature (e.g. Weber & Bates, 1978), but the section to which they belong is under revision by Mr D. Blaxell (National Herbarium of N.S.W.) and their names are subject to possible alteration.



Figs. 1-3 1. *Prasophyllum archeri.* 2. Putative hybrid between *P. archeri* and *P. despectans.* 3. *P. despectans* (a, raceme; b, flower; c, column from the front more or less opened). Note that several features, for example labellum shape and the angle of the sinus between the lateral sepals, can not be determined from the illustration due to the affect of perspective. Illustrations by L. Dutkiewicz.

In Table 1 the more important characters of the putative parental species and the putative hybrid are indicated. The specimens illustrated (Figs. 1-3), and on which Table 1 is based, were selected to represent the entire known morphological range of this population. The putative hybrid shows intermediacy in the dimensions of many vegetative and floral structures. The perianth of the hybrid tends to be less spreading than in *P. archeri* but more than in *P. despectans.* The petals are longer than either parent. The colour of the petals of *P. archeri* is green, of the putative hybrid greenish towards the base but purplish towards the apex, and of *P. despectans* purple throughout. The labellum of the hybrid resembles that of *P. archeri* in having a ciliate margin, but is intermediate in shape between the parent species. The most conspicuously intermediate character is in the column appendages (Fig. 2c) which equal the anthers in height; in *P. archeri* (Fig. 1c) they are shorter; those in *P. despectans* (Fig. 3c) exceed the anthers. Like *P. archeri,* but unlike *P. despectans,* these appendages are fimbriate in the hybrid. The anther point of the hybrid is intermediate in



Map 1. Occurrence in South Australia of *Prasophyllum archeri, P. despectans* and their putative hybrid (triangle). and further distribution of *P. archeri* (dot).

length between the parents. The ovary has not been observed to become swollen after fertilization as in *P. archeri* and *P. despectans* the ovaries of which reach 1 mm or more in diameter. This is considered as an indication of sterility.

Specimens examined

P. archeri x *despectans*

SOUTH AUSTRALIA: South-Eastern Region (13). Honan's Scrub, 37° 42′ S; 140° 36′ E, *R. Bates s.n.*, (AD 97807180). This sheet includes a specimen of each parent and of the putative hybrid. Coloured photographic prints are included with the specimens. Honan's Scrub, *R. Bates 724* (AD 97846390).

P. archeri

SOUTH AUSTRALIA: Southern Lofty Region (11). Mount Compass, 35° 21′ S; 138° 37′ E, *E. Ashby s.n.*, (AD 97518186); *McEwan s.n.*, (Herb. *R.S. Rogers 2720;* (AD 97736209), Herb, *R.S. Rogers 2721;* (AD 97736212)). *R.S. Rogers 2718* (AD 97316323, AD 97736211, AD 97736213). *R.S. Rogers 2719* (AD 97736210). Nangkita, 35° 21′ S; 138° 42′ E, *R. Bates 1004* (AD 97614237).

South Eastern Region (13). Honan's Scrub, *R. Bates 1052* (AD 97629433). *R.C. Nash s.n.* (AD 97027092).

P. despectans

SOUTH AUSTRALIA: South Eastern Region (13). Honan's Scrub, *R. Bates 1050* (AD 97629429).

Table 1. Characters by which *Prasophyllum archeri* and *P. despectans* differ and the state of these characters in the putative hybrid.

Feature	P. archeri	Putative hybrid	P. despectans
Plant height	6-14 cm	8-12 cm (6 collections)	5-20 cm
Scape diameter	c. 0.8 mm	c. 0.5 mm	c. 0.4 mm
Flower number	3-8, crowded	3-15, not crowded	3-20, not crowded
Distance between tips of lateral sepals	c. 7 mm	c. 5 mm	3-4 mm
Flower colour	red and green	purple and green	purplish
Labellum dimensions	c. 3 x 1.5 mm	c. 3 x 1 mm	c. 2.5 x 0.6 mm
Labellum colour	green, edge red	maroon	purple
Labellum margin	ciliate	ciliate	irregularly serrulate to entire
Labellum apex	bluntly acute, recurved	acute, recurved	acuminate, straight
Lateral sepal length	4-5 mm	4-5 mm	3-4 mm
Lateral sepal shape	crescentic	curved, divergent	straight, divergent
Angle of sinus between lateral sepals	more than 90°	75° — 90°	45° — 60°
Petal dimension	c. 3 x 0.9 mm	c. 4 x 0.9 mm	c. 1.5 x 0.6 mm
Petal shape	lanceolate, straight	narrow lanceolate, falcate	ovate, acuminate falcate
Column appendages	shorter than anther point fimbriate	as high as anther point fimbriate	higher than anther point smooth.
Column tip	wide, bluntly acute, straight	acute, straight	acuminate, incurved
Anther appendage	c.0.4 mm long, acuminate	c. 0.25 mm long, acute	c. 0.05 mm long, mucronate
Ovary diameter (unfertilized)	c.0.7 mm	c. 0.7 mm	c. 0.5 mm

The characters are based on the limited number of specimens examined from Honan's Scrub.

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FOUR NEW SPECIES OF *EUCALYPTUS* L'HÉRIT. FROM SOUTH AUSTRALIA

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Abstract

Three new species of *Eucalyptus* are described from South Australia: *E. calcareana* from between the southern boundary of the Nullarbor Plateau and the Great Australian Bight, *E. sparsa* from the ranges in the north-west of South Australia and their vicinity, and adjacent ranges in Western Australia, and Northern Territory; and *E. yumbarrana* scattered in the arid west of South Australia. Data are presented for raising *E. oleosa* F. Muell. ex Miq. var. *peeneri* Blakely to specific status. All taxa are illustrated, specimens examined are listed, and the species relationships and ecology discussed.

1. **Eucalyptus calcareana** C.D. Boomsma, sp. nov.

Arbor, vel robusta multicaulis lignotubiferque vel parva unicaulisque, plerumque usque 10 m alta, interdum altior; cortice veteri pallide griseo in laciniis longis decorticantibus et corticem laevis, primum subroseum, exponenti; medulla guttas olei continenti. *Plantula* dierum ducentorum *cotyledonibus* reniformis, plerumque ad apicem parum incisuris, *foliis* petiolatis, primis 3-4 paribus decussatis, pare primo elliptico, paribus distalibus ovatis usque ovato-lanceolatis. *Folia adulta* alterna, petiolata, 9-12 x 1.4-2.0 cm petiolo usque 2 cm longo excluso, lamina lanceolata, falcata apice uncinato, ravido-virida, vix nitida; costa in pagina inferiore sulcata; nervatura secundaria reticulata, indistincta; guttis olei copiosis, *Inflorescentiae* umbellae axillares 7-11 florum pedicellarium; pedunculo robusto, angulato, sursum dilatato, 7-10 mm longo; pedicellis manifestis, 2-3 mm longis. *Alabastra* 6-8 x 4-5 mm; operculo hemispherico, obtuse conico, striato-costato, costis nonnullis in torum obconico-pyriformem decurrentibus. *Antherae* plus minusve basifixae, versatiles, obovoideae, loculis distinctis, loculicidis. *Fructus* in pedicello 1-2 mm longo portatus; *toro* obconico-pyriformi, 5-7 x 5-8 mm, ad basim attenuato, vix costato-striato; disco angusto, introrsum devexo, vix elevato planatove; valvis 4 (5), rimam aequatis vel vix excedentibus, triangularibus, ab obturamento sub dehiscentiam liberato obtectis; *seminibus* depressis, convexis, in ambitu late ovato-acutis, rufis, politis, in ca. 20 series areolarum polygonalium sculptis.

Holotypus: South Australia, 43 km along Eyre Highway W. of Nundroo, 31° 29′ S, 131° 53′ E, 11.3.77, *G.C. Cornwall* (AD).

A robust mallee to small tree, usually to 10 m, occasionally higher, with bark smooth, pinkish-white when freshly exposed by the shedding in short strips of the pale greyish old bark; pith containing oil glands. *Seedling* (at 200 days old): *cotyledons* reniform, usually slightly notched at apex; *leaves* petiolate, first 3-4 pairs decussate, first pair elliptical, subsequent pairs ovate to ovate-lanceolate. *Adult leaves* alternate, petiolate, 9-12 x 1.4-2.0 cm excluding the petiole to 2 cm long, lamina lanceolate, falcate with a hooked apex, greyish-green, scarcely shining; midrib furrowed on lower surface; secondary venation reticulate, indistinct; oil glands copious. *Inflorescences* axillary umbels of 7-11 pedicellate flowers; peduncles robust, angular, dilated upwards, 7-10 mm long; pedicels distinct, 2-3 mm long. *Buds* 6-8 x 4-5 mm; operculum hemispherical, obtusely conical, striate-costate with some ribs continuing onto the obconical-pyriform torus. *Anthers* versatile, ± basifixed, obovoid with cells distinct, opening by longitudinal slits. *Fruit* borne on pedicel 1-2 mm long, torus obconical-pyriform, 5-7 x 5-8 mm, tapered towards the base, weakly costate-striate; disc narrow, sloping inwards, flat or slightly raised; valves 4(5), level with or just exserted above rim, *seeds* flattened-convex, broadly ovate-acute in outline reddish-brown, glossy, shallowly sculptured into about 20 rows of polygonal areolae, covered by plug which is released at dehiscence. (Fig. 1.)

As flowers were present on some individuals in April it is likely to be an autumn flowering species.

Distribution (See Fig. 2)

Fig. 1 *Eucalyptus calcareana* C.D. Boomsma. a, anther, X 25; b, large fruit from Nundroo; c, seeds, X 7; d, enlarged segment of dorsal seed surface; e, plug from apex of capsule; f, seedling 100 days old. (Illustration from holotype except b, which is from Nundroo, *F. Mason*, 1974.)

Current records indicate that this species flourishes as a tree on the lower slopes of sheltered, linear depressions or narrow valleys westwards from near Penong spaced at irregular intervals along the fringe of the Nullarbor Plain in its south-eastern sector. On the comparatively drier more exposed mid to upper slopes, and occasionally the crests, it is reduced to a mallee and is associated there with one or more of *E. yalatensis* C.D. Boomsma, *E. oleosa* F. Muell. ex Miq. and *E. gracilis* F. Muell.

Selection of Specimens examined

SOUTH AUSTRALIA: 5 km W. of Penong, 31° 56′ S., 132° 50′ E, 10.3.77, *G.C. Cornwall* (AD); 90 km along Eyre Highway W. of Nundroo, 31° 15′ S, 131° 25′ E, 10.3.77, *G.C. Cornwall* (AD); 68 km along Eyre Highway W. of Nundroo, 31° 18′ S, 131° 41′ E, 10.3.77, *G.C. Cornwall* (AD); 22 km along Eyre Highway W. of Nundroo, 31° 37′ S, 132° 03′ E, 11.3.77, *G.C. Cornwall* (AD); Nundroo, 31° 46′ S, 132° 21′ E, September 1974, *F. Mason* (Woods and Forests Department, Adelaide); near head of Gt Aust. Bight, 31° 25′ S, 131° 18′ E, 16.6.76, *G.C. Cornwall* (Woods and Forests Department, Adelaide); 5 km W. of Yalata, 31° 27′ S, 131° 38′ E, May 1973, *B. Lay* (AD, Department of Agriculture and Fisheries); 130 km W. of Cook Road X Eyre Highway, 31° 28′ S, 129° 34′ E, 2.4.77, *M.I.H. Brooker* (AD).

WESTERN AUSTRALIA: Eucla Pass, 31° 41′ S, 128° 53′ E, 2.4.77 *M.I.H. Brooker* (AD).

Discussion

Westwards from the recorded distribution in South Australia, it appears to be replaced in sub-coastal areas of Western Australia by *Eucalyptus conglobata* (R.Br. ex Benth.) Maid. and *E. fraseri* (Brooker) Brooker on uplands, viz. Fraser Range.

Gardner (1960) regarded *E. pileata* as having a constant mallee form, a costate operculum which is wider than the smooth torus, lustrous leaves, and a fruit which "is never deeply ribbed or corrugated". However, tree forms to 15 m high have been observed in woodland with *Eucalyptus dundasii* Maid. by P. Lang (pers. comm.).

In contrast, *E. calcareana* usually has a tree form (to 10m high), often being the tallest and most shapely tree in the region, although mallee forms occur on shallow rocky and exposed sites. The adult leaves are coarser, sage-green, scarcely shining or glossy when fresh, and with a length-breadth ratio of (6-) 7(-9) compared with (5-) 6(-9) for the more variable leaves of *E. pileata.* As shown in Fig. 1(b), the torus of the fruit is markedly costate and the operculum may not be regularly wider than the torus.

The lustrous red-brown seeds place *E. calcareana* in the series *Dumosae* of Pryor and Johnson (1971), with an affinity to *E. pileata* and *E. fraseri.* Both *E. fraseri* and *E. conglobata* have adult leaves which are coarse, often wider to 3 cm, a length-breadth ratio of 5(-6), and consistently larger buds and fruits.

Because of the close relationship of *E. calcareana* to some forms of *E. pileata,* subspecific status might be thought more appropriate, but its distinctions are sufficiently clear for it to be recognised as a separate species.

The specific name alludes to its presence on soils associated with limestone.

2. **Eucalyptus sparsa** C.D. Boomsma, sp.nov.

Arbor, interdum unicaulis, parva, plerumque multicaulis lignotubiferque, robusta, usque ad 6 m alta; cortice in 2/3 partibus infernis trunci persistenti, cinereo usque cinereo-brunneo, aspero, ex laciniis brevibus latisque amplitudine variabili, 5-10 x 2-5 cm constanti; medulla guttas olei interdum continenti. *Plantula* dierum ducentorum *cotyledonibus* parvis, ad apicem vix lobatis incisurisve, *foliis* decussatis, petiolatis, crassis, pare primo anguste oblongo-lanceolato, plano, paribus distalibus latioribus usque ovatis, superne concavis, nervatura manifesta, vix reticulata, guttis olei paucis obscurisque, paribus saltem primis septem ravido-viridibus, distalibus viridibus nitidis. *Folia adulta* alterna, petiolo manifesto 1.5-2.5 cm longo, lamina lanceolata usque ovato-lanceolata ovatave, 5-12 x 1.5-3.5 cm, plerumque usque ad 4 plo longiore quam latiore, apice acuto, base rotundata, in vivo nitida viridi, vix flexibili, in sicco plerumque flavo-viridi rigidissima; costa in paginis ambabus manifesta prominentique; nervatura manifesta, grosse reticulata, vena intramarginali 1.5-3.5 mm a margine remota; guttis olei paucis obscuris. *Inflorescentiae* paniculatae, terminales axillaresque; pedicellis brevibus. *Alabastra* operculo late conico-hemispherico, plerumque toro cupulato-hemispherico multo breviore. *Fructus* in pedicello 1.5-2.5 mm longo, robusto tereti, in sicco compresso vel ± angulato portatus, cupulato-hemisphericus, longitudine latitudinem aequanti, 4.5-6 x 4.5-6 mm, pariete lato, saepe orificio parum constricto; valvis parvis, (3)4(5), rimam aequatis vel infra *seminibus* depressis, convexis, in ambiut late ovato-acutis, 1.3-1.7 x 0.9-1.2 mm, ravido-brunneis, in ca. 15 series areolarum 4-6 lateribus non profunde sculptis.

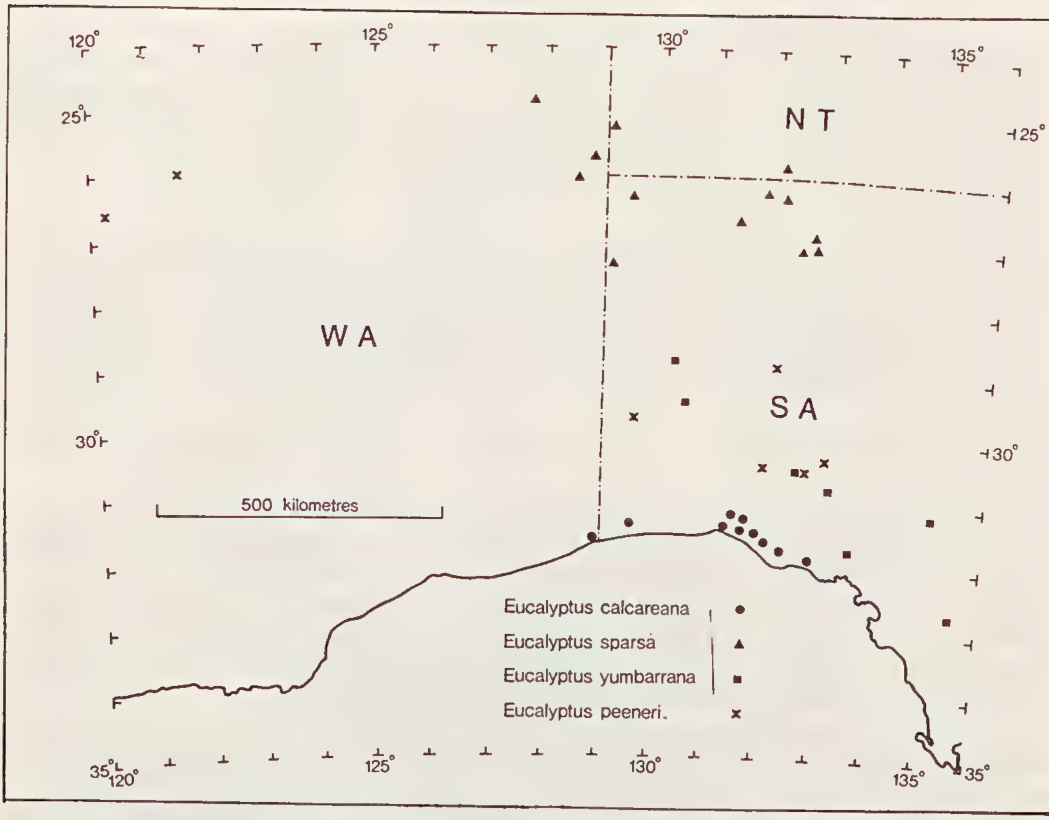

Fig. 2. Distribution map.

Holotypus: Betty's Creek Gorge, Everard Ranges, 26° 57′ S, 132° 39′ E, 4.10.74, *C.D. Boomsma* (AD). *Isotypus* (Woods and Forests Department, Adelaide).

Sometimes a small tree, but usually a robust mallee to 6 m high; bark persistent, grey to greyish-brown, rough on lower two thirds of trunk, composed of short broad flakes of variable size, 5-10 x 2-5 cm; pith occasionally containing oil glands. *Seedling* (at 200 days old): *cotyledons* small, weakly lobed or notched at apex; *leaves* decussate, petiolate, thick, first pair narrow oblong-lanceolate, flat, subsequent pairs wider to ovate, concave from above, with venation distinct, scarcely reticulate, with oil glands few and obscure, at least the first seven pairs greyish-green, subsequent pairs shining green. *Adult leaves* alternate, with distinct petiole 1.5-2.5 cm long, lamina 5-12 x 1.5-3.5 cm, length: breadth ratio usually less than 4:1, lanceolate to ovate-lanceolate or ovate, apex acute, base rounded, glossy mid-green and scarcely flexible when fresh, usually yellow-green and strongly rigid when dried; midrib prominent and raised on both surfaces; venation distinct, coarsely reticulate, with intramarginal vein distant from margin by 1.5-3.5 mm; oil glands few and obscure. *Inflorescences* paniculate, both terminal and axillary; pedicels short. *Buds* with operculum broadly conical-hemispherical, generally much shorter than the cupular-hemispherical torus. *Fruit* borne on stout pedicel 1.5-2.5 mm long, terete, compressed or ± angular when dried; *torus* cupular-hemispherical, as long as broad, 4.5-5 x 4.5-6 mm, thick-walled, often with slightly constricted orifice; valves small, (3)4(5), lower than or level with rim; *seeds* flattened-convex, broadly ovate-acute in outline, 1.3-1.7 x 0.9-1.2 mm, greyish-brown, shallowly sculptured into about 15 rows of 4-6-sided areolae. (Fig. 3.)

Fig. 3. *Eucalyptus sparsa* C.D. Boomsma. a, inflorescences; b, seedling 150 days old; c, branchlet; d, anther, X 25 e, seed, X 15. (Illustration from holotype except a, d and e, which are from Lameroo, *ex cult.*)

Distribution (See Fig. 2)

The distribution of this species ranges from the summit of Mt Woodroffe and other rocky mountains and hills to favoured 'run-on' plains at the base of ranges in the Desert Province as follows: *Western Australia* Rawlinson and Blackstone Ranges; *Northern Territory* Mulga Park Pastoral Station; *South Australia* Everard, Tompkinson, Mann, Musgrave, Birksgate Ranges, Patricia Hills, and Cheesman Peak.

Specimens examined

SOUTH AUSTRALIA: Summit of Mt Woodroffe, 26° 15′ S, 131° 51′ E, 18.9.55, *J.L. Johnson* (Woods and Forests Department, Adelaide), Patricia Hills, 27° 22′ S, 129° 10′ E, April 1966, *R.B. Major,* (Woods and Forests Department, Adelaide); Victory Bore,Everard Range,27° 04′ S, 132° 30′ E, 9.9.76, *D. Morgan* (Woods and Forests Adelaide); Tompkinson Range, 26° 20′ S, 129° 30′ E, 24.9.55, *J.L. Johnson* (Woods and Forests Department); Bull's Hill, Currie Creek Basin, 26° 40′ S, 131° 25′ E, 1.10.55, *J.L. Johnson* (Woods and Forests Department, Adelaide); Everard Range, 27° 02′ S, 132° 45′ E, January 1973, *D.E. Symon* (ADW).

NORTHERN TERRITORY: Mulga Park Station, 24° 50′ S, 132° 45′ E, 1960, *J.B. Cleland* (AD), *5.8.1957, N. Forde,* (NT); 32 km SSW. Docker R. settlement, Petermann Range, 25° 09′ S, 129° 06′ E, 4.11.1970, *C.R. Dunlop* (NT).

WESTERN AUSTRALIA: Blackstone Range, 26° 02′ S, 128° 23′ E, 8.1.73, *D.E. Symon* (ADW, Woods and Forests Department, Adelaide), 47 km NNW. Wingelinna, 25° 42′ S, 128° 45′ E, 30.10.1970. *C.R. Dunlop* (NT).

Discussion

The brief description in Black (1952) of *E. largiflorens* F. Muell. var. *xanthophylla* Blakely (1934) agrees quite well with that of *E. sparsa* but is misapplied. *E. largiflorens* var. *xanthophylla* has been listed as synonymous with *E. normantonensis* Maiden and Cambage by Pryor and Johnson (1971).

As the broad leaves of *E. sparsa* are lustrous green when fresh and lustrous yellowish and rigid when dried, these leaf characters are generally sufficient to separate *E. sparsa* from the other two northern boxes in South Australia, *E. microtheca* F. Muell. and *E. intertexta* R.T. Baker, which have narrower, dull and flexible leaves. This coarse-leaved box is referable to the series *Largiflorentes* of Pryor and Johnson (1971) or subseries *Subplatyphyllae* of Blakely (1934). Its robust mallee habit and wide, persistent, intermediate, broad-lanceolate leaves suggest that it could be placed near *E. behriana* F. Muell.

It most frequently grows on coarse-textured well-drained soils, on hill slopes or on plains receiving 'run-on' drainage from rocky slopes in contrast with *E. intertexta* and *E. microtheca,* which are closely associated with drainage channels, creeks and waterways.

The specific name refers to its sparse occurrence in South Australia.

3. **Eucalyptus yumbarrana** C.D. Boomsma, sp. nov.

Arboar, vel multicaulis lignotubiferque effusa usque robusta, vel unicaulis parva umbrosa, interdum ramis cernuis; medulla guttas olei carenti. *Plantula* dierum ducentorum *cotyledonibus* in duos lobos lineares incisis, *foliis* decussatis, paribus saltem 12 primis sessilibus vel fere ita, pare primo lineari, paribus ca. 8 distalibus latioribus usque ellipticis, ultimis ovato-lanceolatis decurrentibusque. *Folia adulta* saepe foliis praematuris latis paucioria, alterna, petiolo angulato-compresso, 2.0-3.5 cm longo, lamina crassa, lanceolata, 10-12 x 2.0-2.4 cm, falcata, base plerumque rotundata, interdum attenuata, apice longo, acuminatoque, in unco manifesto terminanti, hebeti pallido-viridi sed saepe in sicco pallido-flavovirenti. *Inflorescentiae* umbellae axillares 7(9) floribus; pedunculo 6-11 mm longo, robusto, angulato-compresso, apice dilatata; pedicellis 3-5 mm longis, angulatis, ad basem per longitudinem totam attenuatis. *Alibastra* operculo rostrato, toro longiore et ad juncturam commissuralem latiore; stylo in operculum extensissimo. *Stamina* manifeste flava, antheris versatilibus, parvis, bilobatis, ellipsoideo-globosis, a poris orbicularibus dehiscentibus. *Fructus* in pedicello interdum subangulato, ad basem per longitudinem totam attenuato portatus; *toro* hemispherico-suburceolato, plerumque paulo longiore quam latitudinem, 0.9-1.1 x 0.8-0.9 cm, orificio parum constricto; pariete lato, robusto; valvis subulatis, fragilibus, exsertis sed saepe non nisi basibus remanentibus; *seminibus* depressis, convexis, in ambitu late ovato-acuminatis usque oblongo-obtusis, ravido-brunneis, splendidis, in ca. 20 series aerolarum polygonalium non profunde sculptis.

Holotypus: South Australia, Yumbarra Conservation Park, 31° 45′ S, 133° 35′E,17.6.77, *T. Dennis* (AD 97726343). *Isotypus* (AD 97726344).

Fig. 4. *Eucalyptus yumbarrana* C.D. Boomsma. a, branchlet; b, fruit; c, seedling 200 days old; d, bud at anthesis; e, anther, X 30; f, seed, X 15. (Illustration from holotype.)

A straggly to robust mallee or small umbrageous tree, sometimes with drooping branches; pith lacking oil glands. *Seedling* (at 200 days old): *cotyledons* bisected into two linear lobes; *leaves* decussate, at least first 12 pairs sessile or nearly so, first pair linear, subsequent pairs wider to elliptic for about 8 pairs, finally ovate-lanceolate and decurrent. *Adult leaves* often outnumbered by broad pre-adult leaves, alternate, with petiole angular-flattened, 2.0-3.5 cm long; lamina thick, lanceolate, 10-12 x 2.0-2.4 cm, falcate, base usually rounded, sometimes attenuate, apex long and tapered, ending in a distinct hook, dull light green but often drying light yellowish-green. *Inflorescences* axillary umbels of 7(9) flowers; peduncle 6-11 mm long, robust, angularly-compressed and flattened, with expanded apex; pedicels 3-5 mm long, angular, narrowed towards base over whole length. *Buds* with operculum beaked, longer than the torus and wider than it at the commissural junction; style extended well into operculum. Stamens distinctly yellow, anthers versatile, small, bilobed, ellipsoid-globose, opening by large orbicular pores. *Fruit* borne on sometimes ± angular pedicel tapering towards base over whole length;torus hemispherical-suburceolate, usually just longer than wide, 0.9-1.1 x 0.8-0.9 cm, slightly constricted at orifice; wall thick, robust; valves subulate, fragile, exserted, but often with only the bases remaining; *seeds* flattened-convex, broadly ovate-acuminate to oblong-obtuse in outline, greyish-brown, lustrous, shallowly sculptured into about 20 rows of polygonal areolae. (Fig. 4.)

Distribution (See Fig. 2)

This species is prominent in mallee patches in arid lands in and about Yumbarra Conservation Park. Its recorded distribution extends from near the western end of the Gawler Ranges (Hiltaba) to near the Western Australian border north of Lake Wyola, a distance exceeding 400 km.

Specimens examined

SOUTH AUSTRALIA: Yumbarra Conservation Park, 31° 45′ S, 133° 35′ S, 10.9.74, *F. Mason* (Woods and Forests Department); James, 30° 45′ S, 133° 10′ E, 8.6.70, *J.L. Johnson and S. Reid* (AD, Woods and Forests Department); Lake Wyola North, 28° 51′ S, 130° 20′ E, 27.5.70, *J.L. Johnson and S. Reid* (Woods and Forests Department); Yaranna Hills, 32° 40′ S, 135° 35′ E, 10.10.72, *D.E. Symon* (ADW); Yumbarra C.P., 31° 45′ S, 133° 35′ E, 26.8.76, *G.W. Anderson* (AD); Eldodeh R.H., Yumbarra, 31° 45′ S, 133° 35′ E, 24.10.70, *B. Lay* (AD, Agriculture and Fisheries Department); 35 km N of Hiltaba, 31° 10′ S, 135° 05′ E, 9.9.72, *A.G. Spooner* (AD); Vokes-Cook, 29° 25′ S, 130° 30′ E, 2.6.70, *J.L. Johnson and S. Reid* (AD);Barton, 30° 30′ S, 132° 40′ E, 17.9.26, *E.H. Ising* (AD).

Discussion

This species has obvious affinities with both *E. socialis* F. Muell and *E. flocktoniae* Maiden. From the former it differs in having broader, thicker, often larger adult leaves, longer petioles to 3.5 cm and larger, thick-walled, truncate fruit, which can have a rugose surface. From *E. flocktoniae* it differs in having broad dull leaves, and large thick-walled fruit which can have a rugose surface. There is little doubt that it belongs to the series *Oleosae* near *E. socialis* in the classification of Pryor and Johnson (1971).

Associated mallees in open scrub patches include *E. incrassata* Labill. and *E. foecunda* Schau.

The specific name refers to the locality of collection of the holotype.

4. **Eucalyptus peeneri** (Blakely)Pryor et Johnson ex C.D. Boomsma, stat. et comb. nov.

Basionym: Eucalyptus oleosa F. Muell. ex Miq. var. *peeneri* Blakely, A key to the eucalypts (1934) 270.

Types: South Australia, Barton [30° S 133° E], *E. Ising 1372,* Sept. 1920 (NSW, lecto; dupl. in AD, FRI, G, K, PERTH, US). East of Ooldea, *H. Deane s.n.,* June 1909 (NSW).

This elusive, poorly collected mallee was briefly described by Blakely (1934) as "spreading, 1.3 m high, with prostrate or erect stems", and "bark light grey and rough to the small branches". In the absence of a holotype, a lectotype is chosen from the syntype

Fig. 5. *Eucalyptus peeneri* (Blakely), Pryor et Johnson ex C.D. Boomsma a, branchlet b, buds; c, intermediate leaf; d, seedling 100 days old; e, seed, X 15; f, branchlet; g, anther, X 25. (Illustrations a and b from syntypes: of c, d, e, f, and g from Eldodeh Rockhole, *B. Lay 490*.)

specimens, NSW 133736-7, which were collected from east of Ooldea and eastwards to Barton, by H. Deane, 1909, and E. Ising, 1920, respectively. Only a few collections, housed in AD, have been made in recent years from Western Australia, at Lorna Glen P.L., 26° 00′ S 121° 31′ E; Wiluna, 26° 35′ S 120° 15′ E; and N.W. of South Australia, at Serpentine Lake, 30° 20′ S 133° 05′ E; Maralinga, 28° 35′ S, 132° 10′ E; N.W. Eldodeh Rockhole, 30° 20′ S 133° 05′ E; and 103 km N of Hughes 29° 45′ S 129° 35′ E.

The seedlings which were grown from seed collected from Eldodeh Rockhole, South Australia, by B. Lay had bisected cotyledons, two pairs of linear leaves and at least eight to ten pairs of narrow-oblong leaves, variously arranged, alternate, opposite or adjacent as in *E. oleosa.* They merged into linear, intermediate leaves 6-7 cm long and were subsequently replaced by ashy-grey, oblong-lanceolate adult leaves. In the latter, oil glands are numerous and conspicuous, venation is obscure, and the size range is 5-7 x 0.8-1.0 cm. The fruit which is sub-globular, 0.7-0.8 cm, with a narrow rim and constricted orifice, has fragile, subulate, exserted valves and a terete pedicel 2-3 mm long, which agrees well with the syntypes. (Fig. 5.)

Discussion

There is an obvious similarity between seedlings of *E. oleosa* F. Muell. ex Miq. and those of its var. *peeneri* Blakely, but an equally obvious divergence is exhibited in the long, linear intermediate leaves of *E. oleosa* var. *peeneri* compared with the elliptical, narrow-lanceolate leaves of *E. oleosa* var. *oleosa.* The differences in the intermediate and adult leaves justify the elevation of var. *peeneri* to a species level as proposed by Pryor and Johnson (1971). If the few records of isolated occurrences of *E. peeneri* properly represent its distribution in southern Australia, then it can be concluded that it is a relict taxon barely surviving in a sufficiently large area to withstand further adverse environmental changes.

During four years in cultivation, it has developed a shrubby habit comprising some twenty stems which have reached 1.4 m high, and has also produced buds and fruits which are in reasonable agreement with those of the syntypes.

Acknowledgements

I appreciate the assistance given to me by Dr J. Jessop, the late Mr J. Carrick for reading this paper and Dr W.R. Barker for kindly supplying the Latin descriptions. I appreciate being given permission by Dr L.A.S. Johnson, Director of the Royal Botanic Gardens and National Herbarium, Syndey, to publish the change of status of *Eucalyptus oleosa* F. Muell. ex Miq. var *peeneri* Blakely. To the Director of the Woods and Forests Department, Mr P.M. South, I am indebted for permission to offer this paper for publication. The illustrations were drawn by Mr L. Dutkiewicz, Adelaide Botanic Gardens.

During recent years many seedlings have been grown by the Nursery at the Adelaide Botanic Gardens by kind permission of the Director, Mr T.R.N. Lothian.

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AMENDMENTS TO THE THIRD EDITION OF J.M. BLACK'S FLORA OF SOUTH AUSTRALIA. I.

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Abstract

Corrections and 34 new distributional records are listed in a first supplement to the third edition of volume one of J.M. Black's 'Flora of South Australia' (1978).

This is the first contribution in a series of supplements to the third edition of J.M. Black's 'Flora of South Australia'. At present only one volume of this edition has appeared (Black, 1978) and the following amendments apply only to this volume. Contributions to this series are invited.

Page 3, line 2.
1 December, 1951 should read 2 December, 1951.

ADIANTACEAE
Page 51, line 3 from below.
New record for *Anogramma leptophylla* from the Flinders Ranges region (Mt Remarkable, 16.viii.1927, *Cleland s.n.*, AD97301194).

ZOSTERACEAE
Page 73, line 24
Key to *Zostera*, lead 2(bis) should read: Roots 2 at each node . . .

POTAMOGETONACEAE
Page 78, line 9 from below.
New record for *Potamogeton crispus* from the S.E. region (between Penola and Struan, 23.i.1965, *D. Hunt 2330*, AD).

JUNCAGINACEAE
Page 83, line 27.
New record for *Triglochin hexagonum* from the Lake Eyre region (ca 5 km west of Curdimurka around Margaret overflow, 3.x.1978, *Weber 5697*, AD).

GRAMINEAE
Page 99.
Annotations on Fig. 59 should read 1st and 2nd lemma, not 1st gl. and 2nd gl.

Page 131, line 27.
Vernacular name of *Aristida behriana* should read Brush-wire-grass.

Page 136, line 11.
New record for *Bromus diandrus* from the Lake Eyre region. (Margaret overflow, 2 km west of Curdimurka Siding, 3.x.1978, *C.R. Alcock 6518*, AD).

Page 136, line 9 from below.
New record for *Bromus rubens* from the Nullarbor region. (near Kidnippy Waterhole, 11.ix.1973, *Donner 4668*, AD).

Page 137, line 18.
Author of *Bromus unioloides* should read (Willd.) Humb., Bonpl. & Kunth.

Page 139, line 19.
Agropyron repens must become a synonym for *Elymus repens* (L.) Gould, *Madrono* 9: 127 (1947); see Melderis (1978, p. 379).

Page 140, line 8.
Elymus caput-medusae must become a synonym for *Taeniatherum caput-medusae* (L.) Nevski, *Acta Univ. Asiae Mediae* ser. 8b, fasc. 17: 38 (1934); see Humphries (1978, p. 342).

Page 142, line 6.
New records for *Hordeum vulgare* var. *distichon* from the Eyre Pen. and Lake Eyre regions. (8 km west of Whyalla, 23.ix.1973, *Chinnock 1238,* AD; ca 10 km west of Curdimurka, along road to Coward Springs, 3.x.1978, *Weber 5778,* AD).

Page 142, line 21.
61. *S. cereale* should read *1. *S. cereale.*

Page 145, line 5 from below.
New record for *Distichlis distichophylla* from the Lake Eyre region (near the Publikhouse Springs [approx. 29° 45′ S; 139° 20′ E], Oct. 1899, *Koch 479,* AD).

Page 147, line 16 from below.
New record for *Festuca rubra* from the Southern Lofty region (National Park, Belair, 27.xii.1956, *Cleland s.n.,* AD97250017).

Page 148, line 13 from below.
61. *L. aurea* should read *1. *L. aurea.*

Page 150, line 14.
New record for *Lolium rigidum* from the Lake Eyre region (stockyard near Jersy Springs, 6.x.1978, *C.R. Alcock 6604,* AD).

Page 153, line 30.
New record for *Poa annua* from the Lake Eyre region (new stockyards 4 km south-east of the campsite, Margaret Creek, 3.x.1978, *C.R. Alcock 6483,* AD).

Page 160, line 13 from below.
New record for *Vulpia ciliata* from the Murray region (ca 5 km west of Murray Bridge, 23.x.1943, *Crocker s.n.,* AD).

Page 161, line 5.
New record for *Vulpia membranacea* from the Southern Lofty region (Waitpinga, 27.x.1974, *Williams 5988,* AD).

Page 161, line 18.
New record for *Vulpia myuros* from the Lake Eyre region (stockyards near Jersy Springs, 6.x.1978, *C.R. Alcock 6606,* AD).

Page 165, line 9 from below.
New record for *Avena fatua* from the Eastern region (Waukaringa, ca 5 km south of Koonamore Station, 24.x.1973, *Crisp 649,* AD).

Page 166, line 12.
New record for *Avena sativa* from the Lake Eyre region (ruins south-east of campsite, Margaret Creek, 3.x.1978, *C.R. Alcock 6478,* AD).

Page 170
New record for *Phalaris paradoxa* from the S.E. region (Millicent, 12.x.1945, *Cleland s.n.,* AD966040214).

Page 175
New record for *Amphipogon caricinus* from the Nullarbor region (Ooldea, July 1917, *S.A. White s.n.,* AD966050923).

Page 181
New record for *Polypogon monspeliensis* from the Lake Eyre region (Coward Springs, 2.x.1978, *C.R. Alcock 6431,* AD).

Page 182
New records for *Monerma cylindrica* from the Lake Eyre and Kangaroo Island regions (Beresford Railway Siding and Bore, 6.x.1978, *C.R. Alcock 6652,* AD; Kingscote, 23.xi.1945, *Cleland s.n.,* AD97129157). Delete Eyre Pen. from distribution known for this species.

Page 183
New record for *Parapholis incurva* from the Yorke Pen. region (S.W. of Corny Point, 22.x.1978, *Spooner 6162,* AD).

Page 185
New record for *Enneapogon caerulescens* from the Lake Eyre region (Hamilton Hill, Mound Springs, 2.x.1978, *C.R. Alcock 6429,* AD).

Page 197
New record for *Eragrostis falcata* from the Murray region (Murray Bridge, March 1910, *S.A. White s.n.,* AD97734185).

Page 197
New record for *Eragrostis japonica* from the N.W. region (Mt Watson, ca 120 km south of the Mann Range, 11.vii.1891, *Helms s.n.,* AD97614425).

Page 202
New record for *Tripogon loliiformis* from the Flinders Ranges region (Ideyaka, 2.ix.1893, *Tate s.n.,* AD97606479).

Page 206
New record for *Cynodon dactylon* from the N.W. region (Ernabella, 23.v.1978, *Jessop 2182,* AD).

Page 223
New record for *Panicum effusum* from the Gairdner-Torrens region (1 km north of Mt Gunson Copper Mines, 24.x.1966, *Eichler 18884,* AD).

Page 226
New records for *Paspalidium clementii* from the Nullarbor and Eyre Pen. regions (Ooldea, July 1917, *S.A. White s.n.,* AD966050907; near Cariewerloo Station, 12.iii.1950, *Gross s.n.,* AD966020277).

Page 229
New record for *Pennisetum villosum* from the Kangaroo Island region (near Kingscote, *collector unknown s.n.,* in Herb, J.B. Cleland, AD97301275).

Page 230
New record for *Pseudoraphis spinescens* from the S.E. region (Gurr's Swamp, Wrattonbully, 29.i.1965, *Hunt 2340,* AD).

Page 244
New records for *Hemarthria uncinata* from the Eyre Pen. and Murray regions (Big Swamp, Flinders Highway, 26.i.1969, *C.R. Alcock 2619,* AD; River Murray, Jan. 1884, *Tate s.n.,* AD97517216).

Page 245
1. *H. hirta* should read *1. *H. hirta.*

CYPERACEAE

Pages 260-269
C. laevigatus and *C. tenellus* are considered alien in Australia; *C. brevifolius, C. rotundus* and *C. sanguinolentus* are considered native to Australia but introduced in South Australia. (See Kloot, 1979.)

Page 263

C. flabelliformis becomes *C. involucratus* Rottb., *Descr. Pl. Rar. Ic. Illustr., Progr.*(1772)22. (See Baijnath, 1975.)

Page 276

New record for *Gahnia trifida* from the Lake Eyre region (Peake ruins, 5.x.1978, *Symon 11411,* ADW).

Page 284

New record for *Machaerina huttonii* from the Lake Eyre region (Mt Dare, Dalhousie Springs, 26.ix.1974, *Symon 9331,* ADW). New record for *Machaerina juncea* from the Lake Eyre region (Hermit Hill, 2.x.1978, *Symon 11179,* ADW).

ERIOCAULACEAE

Page 318

E. carsonii occurs in the Lake Eyre region and not the Flinders Ranges.

LILIACEAE

Page 347

New record for *Lomandra dura* from the Eastern region (8 km north-east of Oodlawirra, 31.ix.1973, *Chinnock 1306,* AD).

Page 361, line 24

XANTHORRHEA should read XANTHORRHOEA.

New record for *Xanthorrhoea tateana* from the Yorke Pen. region (betw. Minlaton and Weavers, 21.x.1978, *Spooner 6135,* AD). Field observation by A.G. Spooner and B.J. Blaylock confirm the difficulty in distinguishing this species from *X. semiplana,* but specimens undoubtedly referable to *X. tateana* do grow in southern Yorke Pen.

IRIDACEAE

Page 369

C. crocosmiflora (Nicholson) N.E.Br. should read *C. crocosmiiflora* (Lemoine ex Morren) N.E.Br.

Page 371

G. byzantinus becomes *G. communis* L., *Sp. Pl.*36 (1753) subsp. *byzantinus* (Mill.) A.P. Hamilton (1978, p. 358).

ORCHIDACEAE

Page 388

Prod. Fl. Nov. Holl. 317 (1810) should read *Prod. Fl. Nov. Holl.* 322 (1810).

Page 410, 4th line from below

Malaxia should read *Malaxis.*

Page 426, line 13.

1910 should read 1810.

Page 434, line 14 from below.

This line should read R.S. Rogers in J.M. Black, *Fl. S. Aust.* 126 (1922).

Page 439, line 1.

This reference should read *Orchids N.S.W.* 98 (1943).

Page 443, line 6.

Delete Tas.

Page 450, line 2.

1818 should read 1908.

Page 456, line 14 from below.

5: 147 should read 5: 174.

Acknowledgements

Collections and information on which this paper is based were provided by Mr C.R. Alcock and Mr P.M. Kloot (Department of Agriculture and Fisheries), Mr D.E. Symon (Waite Agricultural Research Institute), Dr A.G. Spooner, Mr B.J. Blaylock, and Mr J.Z. Weber (State Herbarium of South Australia). Other information comes largely from routine processing of collections in the State Herbarium.

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Index to Vol. 1

Names

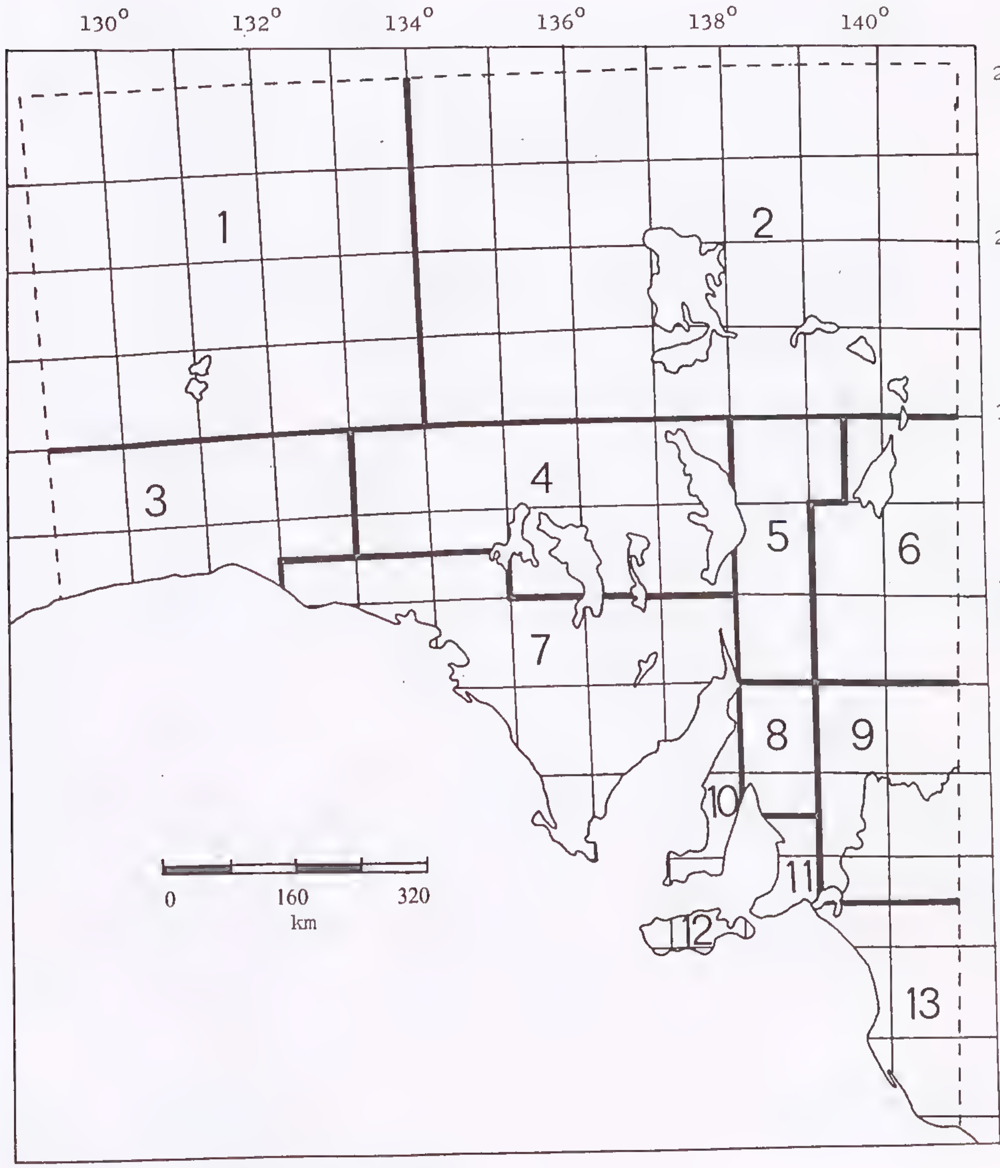
New names and combinations are in **bold.** Synonyms, misapplied, misspelt, illegitimate or invalid names are in *italics.*

Page numbers

Page numbers in **bold** refer to the main taxonomic treatment. Page numbers asterisked (*) refer to figures and maps.

REGIONS OF SOUTH AUSTRALIA ADOPTED BY THE STATE HERBARIUM — ADELAIDE

1. North-western
2. Lake Eyre Basin
3. Nullarbor
4. Gairdner-Torrens Basin
5. Flinders Ranges
6. Eastern
7. Eyre Peninsula
8. Northern Lofty
9. Murray
10. Yorke Peninsula
11. Southern Lofty
12. Kangaroo Island
13. South-eastern



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CONTENTS